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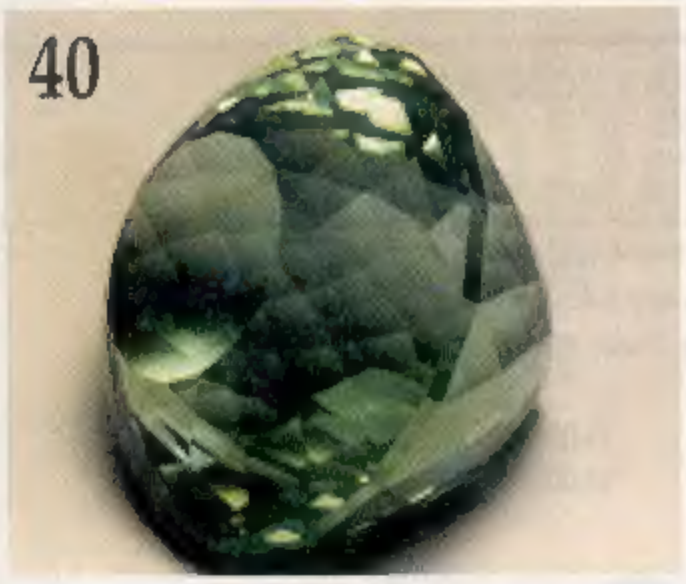

Rock&Gem

Volume 28, Number 7

July 1998

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COVER: This month's cover features the twisted-flute quartz vase by Van Pelt Lapidary. It is filled with tourmaline flowers by the Herbert Klein Carvers of Idar-Oberstein. Photo by Erica & Harold Van Pelt.

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New England Pegmatites

The Jolly Green Giant, next to one of its slices, is now in the Smithsonian Institution.

They Have Been Mined Since America's Earliest Days

by Bob Jones

When the settlers came to the New World, they sought many things, including mineral wealth. They found small amounts of silver and lead, as well as sufficient iron, carbonate and oxide ores to develop the earliest American iron industry. And they found isinglass, which we know today as mica.

In Colonial days, windows were hard to come by. The early settlers often greased paper and used it on window openings. The price of glass was outrageously high, as it had to be shipped to New England from England. In fact, the law *required* that all manufactured goods had to be imported. Consequently, when mica was found in large transparent sheets that could be split thin and used as strong clear window material, the discoverer was pleased, but fearful.

The earliest extraction of mica was from a pegmatite deposit, now called the Ruggles Mine, in Grafton, New Hampshire. Mica was mined there starting in 1803. The farmer who mined it was so secretive, that he smuggled it into Boston where it was sold as imported goods. The threat of arrest hung over his head, as his raw material was not being sent to England to be made into a finished product.

The Ruggles Mine is just one of hundreds of pegmatite deposits in New England, many of which yielded useful mica. Pegmatites are granite-like intrusives but are distinguished from granite because the minerals which make up the pegmatite are hugely crystallized, sometimes many feet long. A pegmatite is made largely of feldspar, quartz and accessory minerals that commonly include mica.

Feldspar mining started in Connecticut around 1825. From that time on, the pegmatites gradually increased in importance, first for industrial minerals and later as a major source of gem crystals in early America.

By today's standards, the New England deposits, save for some in Maine, would today rank rather low on the excitement scale, especially when compared to the San Diego County pegmatites of California, the prolific pegmatites in Brazil and the very recent finds of pegmatite gem minerals in Afghanistan and Pakistan. Still, the New England deposits were very important in their day, and not just as gem or industrial mineral deposits. Mineralogically, they were major sources of important new species described in the early texts by experts from Yale, Harvard and other institutions.

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Fluorite from Hardin County, Illinois. 19cm high, Canadian Museum of Nature. Photography by Jeff Scovil.

Pegmatites/ *from page 12*

Today, the Ruggles Mine is just one of hundreds of pegmatite mines, prospects and outcrops found throughout New England. Unfortunately, save for a few locations like the Ruggles, most of the other sites have been either mined out or closed for safety reasons. The Ruggles achieved some fame this century as a source of rare phosphate minerals, many of which were found in micro crystals only. It was also one of the earliest New England mines to be opened on a fee basis for collectors.

Though an important source of industrial minerals like mica and feldspar, New England's pegmatites are best known as America's early source of gems, with tourmaline and beryl leading the way. During World War II, many mines were re-opened for industrial beryl, a strategic mineral. Yet, even then, the production of gems continued.

The pegmatite deposits are largely concentrated in five major areas, with several lesser occurrences of note. In Connecticut, the major deposits are centered around the Middletown District, early source of pure feldspar. The Bon Ami Company, for example, mined the Hale Quarry for feldspar abrasive for decades. Major gem mines in the Middletown District include the Gillette and the Strickland mines.

To the west of the Middletown District, near the New York border, are the Branchville Quarry in the town of the same name and the Roebling Mine in New Milford. Both produced fine gems in modest quantities. Branchville is mineralogically important as the source of no less than nine new minerals, including dickinsonite, fairfieldite and other manganese phosphates. The Roebling Mine was operated after World War II as a source of uranium minerals, but it is best known for its fine heliodor crystals mined earlier. Mica was also mined as a commercial by-product, a circumstance true of many pegmatites throughout the New England area.

There are no extensive pegmatite districts in Vermont or Massachusetts. New Hampshire, however, is rich in pegmatites, with the Keene and Grafton districts being most important. There are also several minor districts close to the border between New Hampshire and Maine.

New Hampshire has produced wonderful examples of pegmatite minerals, with topaz leading the way. Superb colorless to blue crystals up to several inches have been found here, some having come from what are called myarolitic cavities in the granite. These are generally small vugs in which rare volatile solutions have collected and formed crystal-lined pockets, primarily containing wonderful smoky and amethyst quartz, with the two colors being seen in one crystal, fine feldspar crystals and superb topaz crystals.

Maine boasts two huge and gemologically important pegmatite districts: the Topsham District near the coast and the Paris-Rumford District in the west-central part of the state.

The first tourmalines of gem quality found in America came from near Paris, Maine, when two boys, Elijah Hamlin and Ezekial Holmes, stumbled onto gemmy green crystals scattered by weathering in the detritus of a hillside. This source was developed as the Mount Mica Mine and was a major producer of gems for years.

Maine's last great contribution of gem tourmaline was from the Dunton Pit or Quarry when, in 1972, hundreds of pounds of watermelon tourmalines were found. Most of this was carving-grade material, but hundreds of superb gemmy stones were also cut. The Dunton pegmatite is one of several on Newry Hill, part of Plumbago Mountain in Newry, Oxford County. The find made here was quite unexpected, as the general feeling was that New England pegmatites had seen the last of their halcyon days. This vast and rich find served as an impetus to further pegmatite mining both in Maine and elsewhere.

The find at the Dunton dig was spectacular. Perhaps the best-known single crystal to come to light at that dig was later called the Jolly Green Giant, a watermelon tourmaline with a red center and a green "rind." It measures some 3 inches in diameter, and when I saw it, the length was approaching 10 inches. Parts of it were sliced off, but the major portion of the crystal is preserved in our national museum, the Smithsonian Institution.

An exceptional specimen for New England, this crystal was dug by Frank Perham, who has long been associated with Maine's pegmatites. Frank probably knows as much about Maine's gem mines as anyone, and the Perham shop is always a source of good talk and fine gems.

Frank often tells about being in the gem pocket and how he dug into the soft clay-filled pocket before the tip of a green tourmaline appeared. Using a screwdriver (how many times have you been told *not* to use a screwdriver for mineral collecting?), Frank started to scrape away the enclosing clay. The green crystal was heavily striated and had lovely pyramidal faces forming the termination. As Frank scraped, the crystal kept getting longer and longer, until an almost log-like form emerged. The crystal was not attached to the wall of the pocket, typical of pegmatite tourmalines.

Several explanations have been suggested for the fact that many pegmatite pockets contain crystals broken from where they formed on the walls of the pocket. Ground movement or frost are possible explanations. I like the pocket-eruption theory, wherein the pocket, as it forms, finds extremely high-temperature solutions being concentrated more and more, heated more and more until the remains of the original solution simply flash or explode into steam. Such an event would severely disrupt the pocket contents.

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Pegmatites/ *from page 14*

As Frank slowly freed the Jolly Green Giant from its enclosing clay, he began to hyperventilate. He had dug hundreds of crystals in Maine, but none like this monster. He had to rest every so often to absorb the wonder of it all. Finally, the giant gem was free and he was able to bring it up out of the hole. No one could believe what they were seeing. Frank later told his story on the video *Gemstones of America* as he sat in an open pegmatite quarry on Mount Mica.

Another great find in a Maine pegmatite came about because of the naiveté and enthusiasm of a young New Jersey collector, Terry Szenics. Terry is now a well-known mineral dealer/collector based in South America, where he recently discovered a rare hydrous copper molybdenum mineral now named szenicsite.

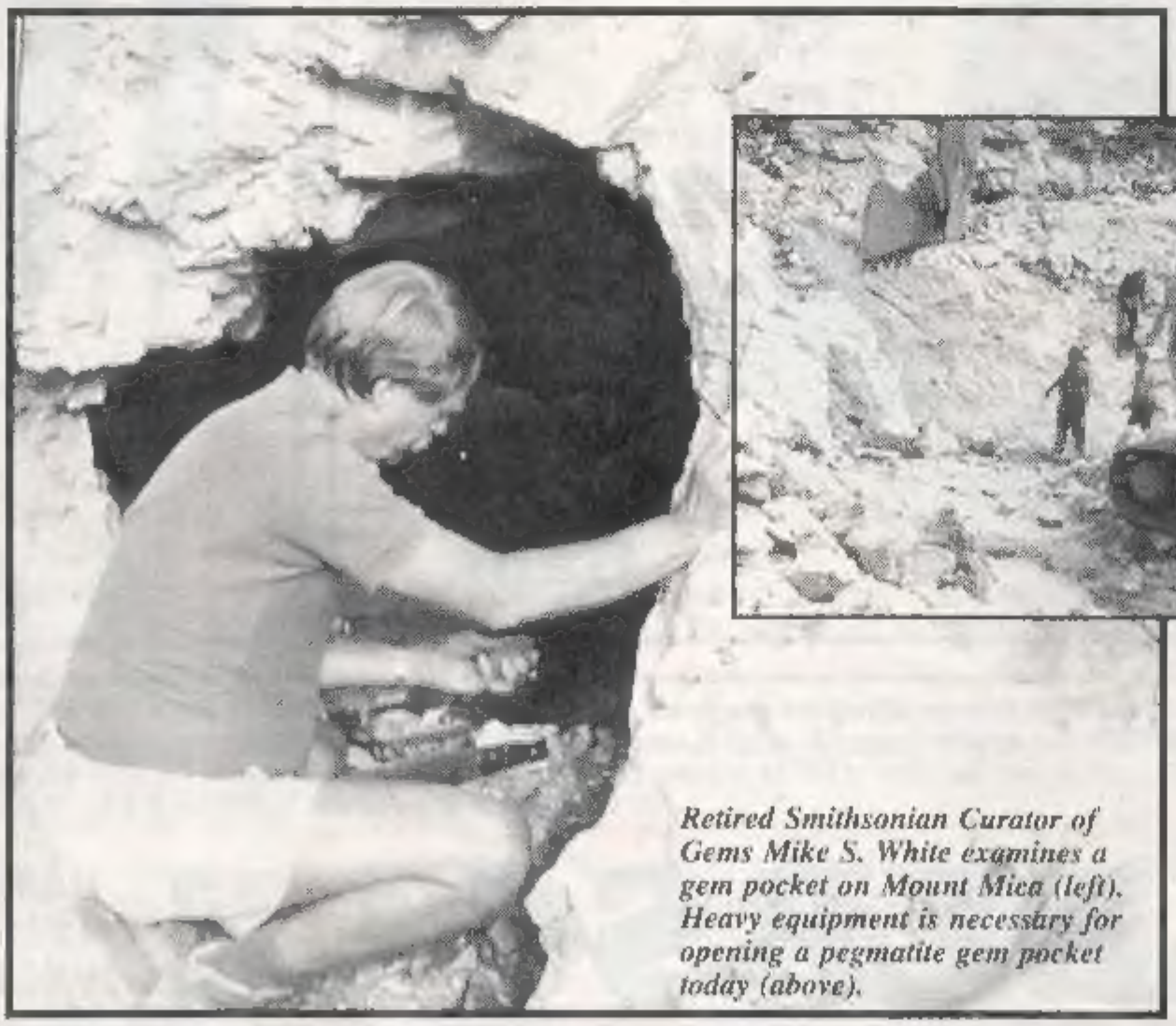
Terry's big discovery came in 1966, when he determined he was going to find some superb purple fluorapatites in the Pulsifer Quarry at Mount Apatite. Terry had long admired the famous Roebling purple fluorapatite in the Smithsonian Collection that had come from the Pulsifer in the early part of this century. Enamored of this beautiful violet-colored crystal measuring 1½ inches by 1¾ inches, Terry determined to attack the Pulsifer pegmatite and replicate the find. He rented some heavy equipment and dug away. In 1966, using heavy equipment just to mine crystals was virtually unknown. People thought him a bit odd, to say the least. But he was a man on a mission!

The results of his risky venture were beyond his expectations, as he mined into the finest pocket of violet fluorapatites to be found at the Pulsifer in decades. Some think his find was the best ever made there. Lovely transparent hexagonal crystals to an inch or more came to light, many on matrix. I recall a New Jersey show some months after Terry's find when he showed me a cigar box full of doubly terminated purple crystals, many an inch thick and approaching 2 inches in length. He had really made a wonderful find, once again proving that Maine pegmatites hold many surprises!

I was never that lucky when working the New England pegmatites. In the early days of my collecting, I was interested mainly in fluorescent minerals. Most localities at that time were either open to collecting or accessible because they were abandoned. When it came time to work on my master's thesis in science, I decided to follow my hobby interest. Armed with a portable long/shortwave ultraviolet lamp, I spent night after night visiting quarries and outcrops all over the state of Connecticut in search of fluorescent minerals. I didn't make any spectacular finds, but did come across lots of interesting things.

One night in the Hale Quarry, I found a spectacular fluorescent area on the wall of the quarry, brilliant blue under both long- and shortwave. It looked like scheelite, but scheelite isn't blue under longwave light and it's a mineral not usually associated with pegmatites. I dug and dug in the dim light of my lamp, getting several masses of the bright rock. Once home, I cleaned my find and it turned out to be a bust. It was drilling oil that had soaked into the feldspar, lighting it up like a blue beacon for my lamp.

All was not lost, however. I did obtain my master's degree and my thesis, *The Luminescent Minerals of Connecticut* was later published commercially. While the Connecticut pegmatites did not yield lots of fine specimens to me, they gave me something more important!



Retired Smithsonian Curator of Gems Mike S. White examines a gem pocket on Mount Mica (left). Heavy equipment is necessary for opening a pegmatite gem pocket today (above).

Probably the most unusual pegmatite mineral I ever collected from a Connecticut pegmatite was pollucite from what was then called the Gotta-Walden Prospect. The Gotta-Walden Farm was close to the famous Strickland Quarry, across the Connecticut River from Middletown in Portland. During an excavation for a farm building, a pegmatite outcrop on the farm was breached and masses of an unusual greasy-looking translucent material came to light among the feldspar and quartz masses. It looked rather like a bubbly wax material. This was later identified as pollucite, a very rare hydrous cesium, sodium, aluminum silicate in the zeolite family. Zeolite minerals are commonly found in small amounts in pegmatites where they form in the last stages of mineralization.

What excited me about this pollucite was that it fluoresced an almost eerie soft green under shortwave ultraviolet light. To top it off, the material could be faceted. Remarkably, even though it is a zeolite, it has a hardness of around 6.5 to 7 on the Mohs scale. Local collectors did their best to obtain specimens of this rare mineral when it was coming from the Gotta-Walden Prospect. Mining commenced, but the deposit never proved to be anything more than a novelty. Still, the fact that it yielded important amounts of a rare mineral made it a noteworthy deposit. Today, huge crystals of pollucite are being found in the pegmatites of Pakistan, the largest being a foot-high complete crystal owned by dealer Herb Obodda.

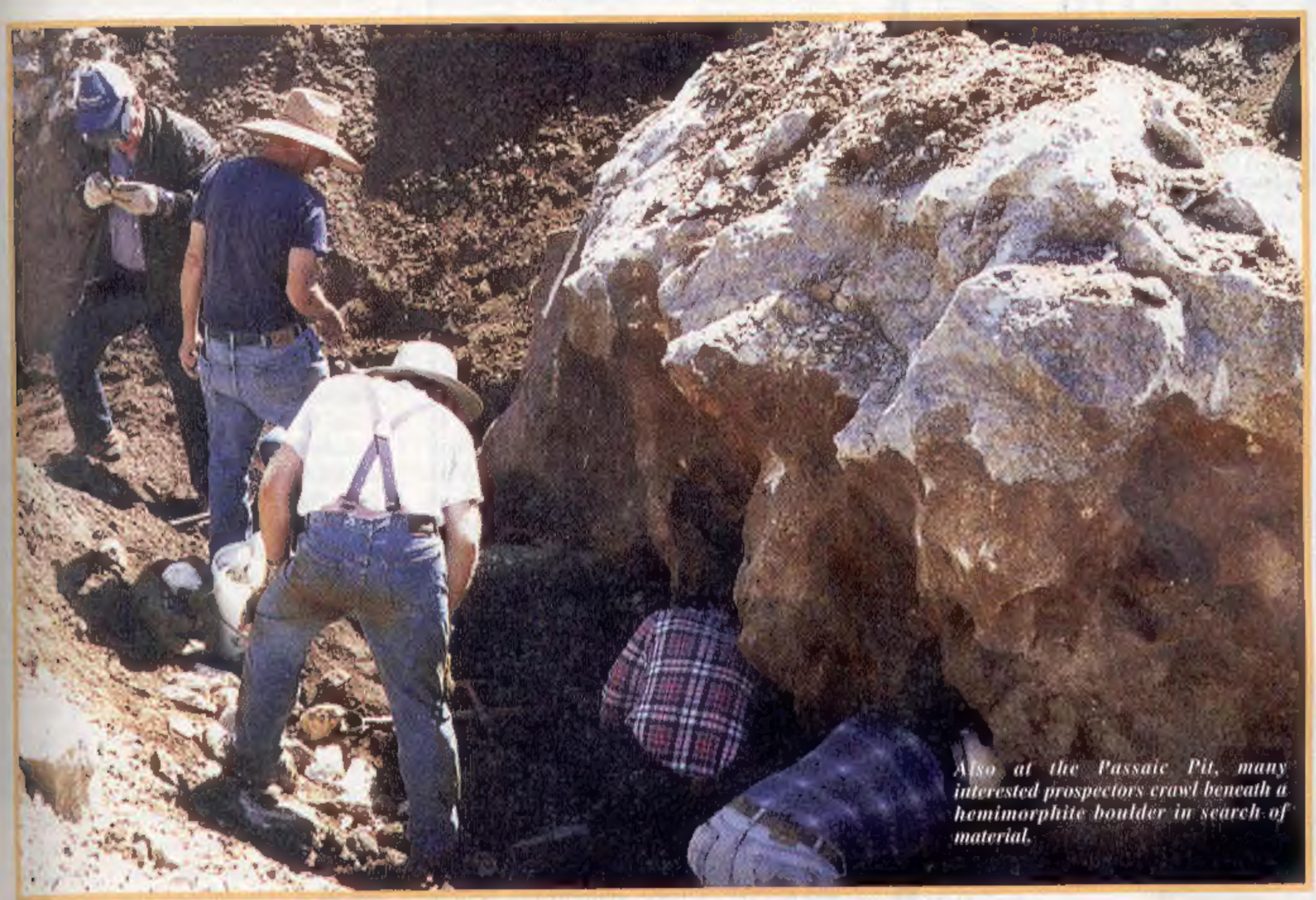
Collecting isn't all that easy in the East anymore. The pegmatites that were once famous and were studied diligently by scientists from Yale, Harvard and other institutions are now closed or have been swallowed up by progress. Yet, there is the occasional exception. Several of the Maine pegmatites, such as at Mount Mica and the Dunton Pit, have been worked in recent years with success by contract miners. The Wise Mine, a source of fantastic gem green fluorite, is being contract-mined. The famous Palermo Mine in New Hampshire, a mecca for rare-species micromounters, is still open on a fee/tour basis.

The best bet for collecting is to be a member of a recognized club which can make special arrangements to enter working properties under tight safety regulations. This, at least, does bring to light the occasional fine specimen, while providing collectors with an opportunity to exercise their hobby.

Though collecting is severely limited today, there are many superb collections in museums and institutions to see. Some of America's most historically important specimens may be seen at Harvard, Amherst, Yale, and the major museums in New York, Philadelphia, Washington and elsewhere. So when you attend an East Coast show or visit the area, be sure to immerse yourself in the historical wealth of minerals to be seen there.

Mark Leger sledges a chunk at the Sterling Hill Mine (above). Boy Scouts visit the Sterling Hill "Mine Run Dump" at the mining museum during a field trip (right). One prospector looks for the stuff that glows during an outing to the Passaic Pit (below).

The Treasures Of STERLING HILL



Also at the Passaic Pit, many interested prospectors crawl beneath a hemimorphite boulder in search of material.

Only An Hour From New York City Is One Of The Greatest And Oddest Mineral Deposits On Planet Earth

by Richard C. Bostwick

The Sterling Hill Mining Museum is in the town of Ogdensburg in northwestern New Jersey, about an hour by road from New York City and light-years distant in atmosphere from Broadway and Times Square. Here, close to the metropolis, but buried in the wooded highlands of Sussex County, is a strange place to have hidden one of the greatest and oddest mineral deposits on Planet Earth. It is stranger still, in a crowded state with a tendency to bury the past and pave it over, to find a mine which preserves a tradition of mining and mineral study dating back more than 200 years.

If you love and collect minerals—particularly fluorescent minerals—you have heard of Sterling Hill. If instead you are a mining buff, you'll certainly find enough mining paraphernalia and atmosphere there to satisfy your thirst for the authentic. This museum accommodates anyone old enough to understand what minerals are, how we get them and why we should care about them. No matter if you are a rockhound living in Manhattan who wants to spend a day with your family in the country, or a collector from California making a pilgrimage to one of the sacred sites of world mineralogy, make no mistake, this is *the* place.

With New Jersey's reputation as a smog blur that exists solely to connect New York City to Philadelphia, it's easy to forget that 50 years ago this state was a paradise for mineral collectors. To the southeast, near the beaches, were treasures of amber, pyrite and vivianite crystals, shark's teeth and belemnites and many other fossils.

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Sterling Hill/ *from page 21*

Along the Northern Corridor itself were the Triassic red beds with their dinosaur footprints and the many basalt quarries of the Watchung Mountains, which yielded world-famous pectolite, prehnite and zeolite specimens. Best of all, to the northwest, over the hump of the Jersey highlands, were the two great zinc ore bodies and the two active mines of the Franklin-Sterling Hill District. Though these mines and most of the quarries are now closed and access is restricted to what remains, some collecting is still possible. However, to appreciate what went on at the Franklin and Sterling Hill mines when they were active, we must turn to the museums that preserve their heritage above the ground and below it.

How truly well-known are Franklin and Sterling Hill? World-renowned among knowledgeable collectors and mineralogists in every quarter of the globe. However, fame is relative. Just 20 years ago, when I was a miner at Sterling Hill, I was asked where I worked by a man who lived not more than 10 miles away. "Sterling Mine? Haw, haw! Whaddya mine there, sterling silver?" If you are tempted to share his reaction, at least bear these stats in mind: In addition to yielding more than 33 million tons of high-grade ore (nearly 20 percent zinc), the district has produced more mineral species (about 350) than any other locality, more fluorescent species (over 80), more species-first-described (69) and more unique species (35). Some of the better-known minerals, such as willemite, franklinite and rhodonite, occur in large, well-formed crystals, and many of the rarer species have their best development here. The district's fluorescent minerals are without doubt the best in the world, unrivaled for brilliance of color, distinctive patterns, and the presence of two or more in a specimen. The ores are chemically distinct, their appearance unique, their mineralogy rich and strange. All this oddness can be off-putting, but I guarantee that if you let Franklin and Sterling Hill get under your skin, you will understand why many regard the district as the world's greatest mineral locality, why preservation efforts there are so important, and why it's worth visiting the place to begin to understand it.

To understand the significance of what has been saved at Sterling Hill since the mine closed in 1986, look at what happened in Franklin. When the great Franklin Mine closed in 1954, it was a traumatic blow for the community, and nothing could be done to prevent the sealing of the mine and the stripping and destruction of the mine and mill structures. (Though the mill property remains undeveloped to this day, the power plant smokestacks, the shell of the change house, and the time and employment offices are all that remains.)

Soon the townspeople and mineral collectors rallied to start the Franklin-Sterling Gem & Mineral Show (the 42nd annual show will be held on Sept. 25-27, 1998). In 1959, the Franklin-Ogdensburg Mineral Society was founded; FOMS remains one of the few locality-focused mineral societies, publishes its own journal (*The Picking Table*) and has over 300 members. FOMS members joined with the Franklin Kiwanis Club to open the Franklin Museum in 1965.

Today the Franklin Museum features large and comprehensive exhibits of local minerals, as well as a 32-foot-long fluorescent display and the Welsh Hall of worldwide minerals. Other museum attractions include a life-size replica of a tunnel and working-place in the Franklin Mine and a mineral-collecting site on the Buckwheat Dump. The Franklin Mineral Museum also sponsors the Franklin-Sterling Gem & Mineral Show, and hosts the regular meetings of the FOMS. This past year saw the dedication of the latest local institution, the Franklin Heritage Museum. It occupies the New Jersey Zinc Company offices on the Franklin mill site, and displays mining and other local memorabilia. Franklin, it appears, has everything now, except its mine.

During the destruction of the Franklin mine and mill, the Sterling Hill mine plugged away steadily in Ogdensburg, two miles to the southwest. The old mill was torn down and a new one was built. A modern five-compartment shaft was sunk from the surface, and the lowest extension of the ore, the North Ore Body, was developed through an internal shaft sunk below the 1,850-foot level. To the delight of collectors, minerals continued to emerge, some of them new to science. Production continued until 1986, when New Jersey property values (and taxes) caught up with the depressed price of zinc.

The mine's owners, with a million tons of ore left in the ground, turned the property over to the town of Ogdensburg in lieu of back taxes. Of course, this was after they had plugged the mine openings and stripped the mine and mill of its hoists and anything else which could be sold. The buildings were left standing, but it appeared that the last mine in New Jersey would shortly meet the same fate as the Franklin Mine: desolation and oblivion. Once the distressed mine property was turned over to Ogdensburg, it quickly became apparent that the town didn't know what to do with it, so in 1989 the mine property was put up for sale at an auction.

Enter the Hauck family, most of whom are collectors of something or other: Edison phonographs, Willys Jeeps, railroad signs and lanterns, military vehicles, books, dolls, Depression glass and, yes, minerals (and dynamite boxes, rock drills, carbide lamps, postcards of mining scenes, mining company stock certificates and letter openers, and, so help me, mining souvenir teaspoons). The Haucks who figure most largely in this tale are Richard and Robert, also known as Dick and Bob, who had spent most of their careers in the family business of raising geraniums and poinsettias.

What happened here? Evidently the Sterling Hill mine was, in their eyes, an irreplaceable and unique cultural, historical, mineralogical and geological treasure. And it is. So they turned their lives upside down and bought it.

The rest is history, as they say. Because the saving of the mine was a project everyone agreed on (a rarity locally), mineral collectors and ex-miners and citizens streamed in, offering their time and money. This is why there are so many names engraved on wall plaques and stenciled on lockers at the museum. Volunteers fixed the buildings, restoring roofs, plumbing and wiring, and scraped and painted and swept.

When the mine adit was unplugged, and Dick and Bob found the water rising in the mine at the rate of a foot a day, volunteers began a massive scavenging project to bring out whatever they could get: specimens, drills, level signs, ore cars, diesel-powered loaders, the lot. Before they were able to rig a hoist, whatever they brought out was carried up ladders by hand, from as far down as the 1,400-foot level. (Ouch.) The site became a magnet, drawing derelict mining equipment from as far away as Arizona and Canada.

By its opening in 1990, the museum had the same basic plan it does now: a visitor center with a snack bar and souvenir shop in the mine offices; the yard outside for parking cars and large pieces of mining gear; below, in the change house, a safe repository for mineral specimens and the more portable and perishable artifacts; and on the opposite side of the yard, Sterling Hill itself. On top of the hill are the hoist and mill buildings, deprived of their machinery but otherwise intact. On its bare face the dark stains proclaim, "The ore was *here*."

Inside the hill, on the adit level of the mine, are tunnels leading to the shaft station, the lamp room, exposures of the ore, and sundry attractions ranging from the educational to the startling.

Since 1990, the Haucks and their helpers have never slowed down. Hundreds of feet of tunnel have been added to the underground leg of the tour and, in two places, where the ore is exposed, batteries of ultraviolet lamps have been installed. Mining artifacts of all sizes continue to stream in, most recently the boiler, stamp mill, and other contents of a Canadian gold mill.

As the museum built momentum, families and foundations have been getting on board. Witness the Christiansen Pavilion, a large canopy sheltering picnic tables outside the visitor center, and the Edison and Landmesser Tunnels, which have doubled the size of the underground tour. Educational funding has also come in from the Merck Foundation, the Geraldine Dodge Foundation, the Edison Fund and others. The results include the Rock Discovery Center, a tour add-on where young

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Sterling Hill/ from page 23

rockhounds are guided in picking up and assembling a basic rock and mineral collection; and the GEMS Program, which is developing the site as an earth science education center, has developed a curriculum and is training teachers.

If all this can be found at the Sterling Hill Mining Museum, what's in it for you? A comprehensive experience of mining, to start with: the tools, the tunnels, the ore, the feel and even the smell of it. Please note that the word "museum" literally means "place of the muses." It is a place where inspiration dwells. The Sterling Hill Mining Museum has that quality. In the mine tour, the underground tunnels are real. They are cool, damp and dark with an indefinable musty smell of damp timber and rusting metal. This is where the miners walked, here is the shaft they went down to mine the ore. There in the dim light you are surrounded by the gear they used—heavy, functional and dully gleaming.

Around each corner there is a surprise—a tableau. This is how they drilled, this is how they blasted and broke the rock, this is how they carried the ore, and where they dumped it. Outside in the open air, strands of past and present continue to weave together. Behind you is where the ore lay, and where slabs of it remain. To your right are the ruins of the old Sterling Hill mill, and ahead and to your left, the buildings which survive and always and everywhere, inside and out, are the tools, the objects and the infinite paraphernalia of mining.

Mining is above all a physical activity, a realm defined by rocks on the one hand and tools on the other. And this is where your imagination comes in. In your mind, pick up a sledgehammer and begin breaking rock (as a collector, how often have you done that?); manhandle the drill into place, begin the rata-tata-tat of drilling; push down the handle of the blasting box to trigger the whumpwhumpwhump of exploding dynamite. Now go to the muck pile and begin pawing through it for crystals.

Your Sterling Hill experience will probably begin in the change house. Let's see what's there now besides a few remaining lockers and the dangling clothes baskets, the ones where you placed your clothes and boots to dry out between shifts. Here in the aisle is something that was never there in my day, one of Mr. Edison's phonographs. Evidently, it's in working condition; it's playing a march. This is not incongruous to the Haucks. Thomas Alva Edison was, after all, in the mining business locally. He developed the magnetic separation process for iron ores at his nearby Edison Mine. (He also lost $2 million when the much cheaper ores of the Mesabi Range became available, but later made it back in cement.) Dick Hauck, our tour guide, is addressing the children, reminding them that this museum is not about mining zinc only, but gold, silver, copper and lead, all of which are here "as they are found in the earth."

He gives them assignments, which they must complete before being allowed to finish the tour: Can they find the dinosaur footprints? Tom's magnetic rock? The gold collection? The 5,000 soda cans, all in one place? As the children disperse, the adults are given their own tasks, such as finding a rock which is too big to pick up, and soft enough to put on your face.

If you choose to browse while the kids scurry, this is some of what you'll find behind glass: not only the gold collection, but also outstanding pieces of native silver and copper; blasting gear like the old-fashioned "push-em-down" detonators, a heater for thawing frozen dynamite; ultraviolet sources of all kinds, including the argon bulbs and iron-arc units used 70 years ago; and a full array of miner's caps and cap lamps and candleholders. There are, of course, specimens: local mineral classics, zinc minerals from other mines, and cave-type formations removed from the Sterling Hill Mine as it filled with water. As this is a famous site for fluorescent minerals, they are there, too, behind a curtain at one end of the hall. And there are a few special larger artifacts, notably the original "port-a-potty": a rusty steel, two-holer on wheels, rather a luxury item underground.

The children are back now, after scratching the talc, tweaking the magnet on Edison's magnetite, rubbing the coal, and sitting on the other large ore samples scattered about the hall. They gather about Dick; it's exam time.

"And did you find the dinosaur footprints?" They did.

"What kind of dinasaur?" Pregnant silence.

"A dead one!"

Oooo, perhaps this won't be so easy after all, but they get by Tom's magnetic rock, and the gold collection ("Where is it? Down in the safe, of course!"). Then comes the clincher:

"Now for the toughie! How many folks were able to locate the 5,000 soda cans? Where are they?"

Fingers point, and the answer follows quickly, "Right in that ugly brown rock called bauxite, because without the miner digging the ore for the aluminum to make the can, we would not have that sip of soda."

The kids are getting into it and now it's time to play Stump the Tour Guide. "Name me," Dick says, "a product that you used this week, made by man, which did not need the miner in its production."

They can't, and that's the point. Luckily all have passed the exam, even the adults, so they can now go into the mine. Dick makes a final plea for environmental conservation and the wise use of resources, and hands the group over to another guide. "I don't like to go underground," Dick protests, "because it's much too dangerous." Eyes roll in the crowd.

In the adit at last, it's damp and cool, about 55 degrees. George Chewey leads us to the lamp room, where each miner picked up his self-rescuer and battery-powered cap lamp before going "down the hole." The self-rescuer is a catalytic converter which changes carbon monoxide to carbon dioxide. If there's a mine fire, you hold the self-rescuer in your teeth and breathe through it. Anyone who works underground in the United States has to carry one. Luckily tourists don't, at least not here.

We go to the shaft station; it's cavernous and a bit spooky, with those four sets of inclined rails going down to nowhere. We are introduced to some ore-cars and the battery-powered "motor" which hauled them, then to the safety box found on every level. It contains a Stokes litter and a blanket, and was reputedly a good place for a miner to catch a nap. We move on; it's time to meet the "grizzly."

Whatever this beast is, it's behind bars. Lights go on, and beyond the bars is a yawning hole, with a grid of rails 15 feet down. The hole is an ore pass and the grid is the grizzly. Ore is dumped here to be broken up in the primary crusher underground before being hoisted up the shaft to the mill. The grizzly is a large sieve, meant to stop chunks of ore too big for the crusher, and the grizzly-man's job is to break up these chunks without falling through himself, and abruptly straddling a grizzly rail with his crotch. A dummy grizzly-man stares mournfully up at us from his post.

George hustles us down the Rainbow Tunnel past an unreal surveyor with real instruments, and into a small side tunnel where a diamond drill is set up. These are the drills used for exploration work; they have a hollow, diamond-tipped bit which passes a core of rock back through the hollow drill steel for recovery and examination by the mine geologist. Then we get a demonstration of the scaling bar, a long pipe with a bent chisel stuck in one end. It's used to tell sound rock from loose rock and to pry off loose rock when you find it. Sound rock rings, and loose rock makes a hollow noise; sure enough, George finds a loose slab, but as he shows us, it's secured with rock bolts. (Grizzlies! Loose rocks! The children are starting to look nervous.)

The next stop is the Rainbow Room, another dead-end tunnel with no particular appeal until George turns off the lights, and switches on several large shortwave ultraviolet lamps. The expectant silence begins to be punctuated with genuine oohs and ahs. The rainbow, right at the end of the tunnel, is an arch of green flanked top and bottom by red haloes.

As funky and appealing as mining paraphernalia can be, it's mostly portable and generally exists in duplicate. In contrast, this mineral exhibit is part of the mine and part of the earth and just as unique and irreplaceable.

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Sterling Hill/ *from page 25*

The lights come on, and George is saying that everyone is allowed one piece from the buckets. The crowd surges forward, small hands wave specimens under the ultraviolet lamps. There are squeals, and cries of "Look what I got." Somebody's happy. Looking at the faces, it seems more like everybody.

We walk outside into the light, on the edge of the Passaic Pit. It's a zone of deep weathering once lined with zinc rich mud supporting thin crusts of hemimorphite (calcium zinc silicate) derived from the primary franklinite-willemite zinc ore. The cliff looming above us is a natural erosion surface, and George points out where veins of zinc ore can be traced across it. Some are looking up at this with interest while others, mostly small ones, are still staring at the rock clutched in their hands.

To finish the tour, we have to go back underground and into the Edison Tunnel, where the actual mining operations are portrayed. We inspect a "drift round," a pattern of drill holes in a blank wall which, if blasted in the proper sequence, will excavate a section of tunnel into that wall. The wires from each blasting cap are neatly tied together, ready to be hooked up to a "firing box," and I am glad there's no explosive in the holes.

Now George decides it's time we should see just how dark it is in a mine, which means absolutely, completely dark. He turns off the lights in the tunnel and his cap lamp, and it really is very dark. I speculate how long it will take to go blind and/or crazy under these conditions. Luckily George lights a candle, enabling me to stay sane and realize what mining was like in the good old days before carbide and electric lamps.

Next stop, a model stope with drills, ladders and more dummies. The miners drilled up-holes and blasted the overhead down, then stood on the broken ore and secured the "back" with roof bolts before removing the ore. Once it was cleaned out, they would raise the floor with piped in wet sand ("hydraulic fill"), cap it with a thin layer of concrete, and keep going up. George explains the process. I wish the dummies would come alive and start mining, but maybe it's their coffee break.

Now we enter the recently drilled and blasted Landmesser Tunnel, which descends gently into an old, somewhat cavernous stope right in the ore. It could have been drilled with hand tools and blasted with black powder, it's hard to know now. Scraps of daylight trickle in from a few ventilation holes that break through to the surface.

The south end of the stope intersects the water table, causing a small lake. What matters is that the miners in this stope apparently did not want to risk working under unstable ground, and left a fair amount of ore to reinforce the walls and overhead. This ore is brightly fluorescent, and the Haucks have installed about 20 shortwave display lamps to take advantage of it. They have also put a flood light just under the surface of the lake. Imagine the possibilities. The net effect is really quite strange and spectacular and, like the Rainbow Room, the Landmesser Tunnel constitutes something marvelous which no longer exists anywhere else and can't be invented. It is a fitting close to the tour.

Back in the visitor center, I note that although Dick and Bob's greatest hope is that the Sterling Hill Mining Museum will eventually function without them, at the moment it is still very much a family concern. Patti Hauck, Bob's wife, is dispensing hot dogs, Snapple and authentic Cornish pasties at the Miner's Lunch Box snack bar. In the souvenir shop, Elna and Rhea, Dick's wife and daughter, are selling tickets, sorting necklaces, making appointments for next season's school tours and organizing tomorrow's guide schedule. I am deciding whether to splurge on one of the handsome museum belt buckles, go after a wollastonite specimen which has been tempting me, or settle for the bumper sticker which says, "A mine is a terrible thing to waste."

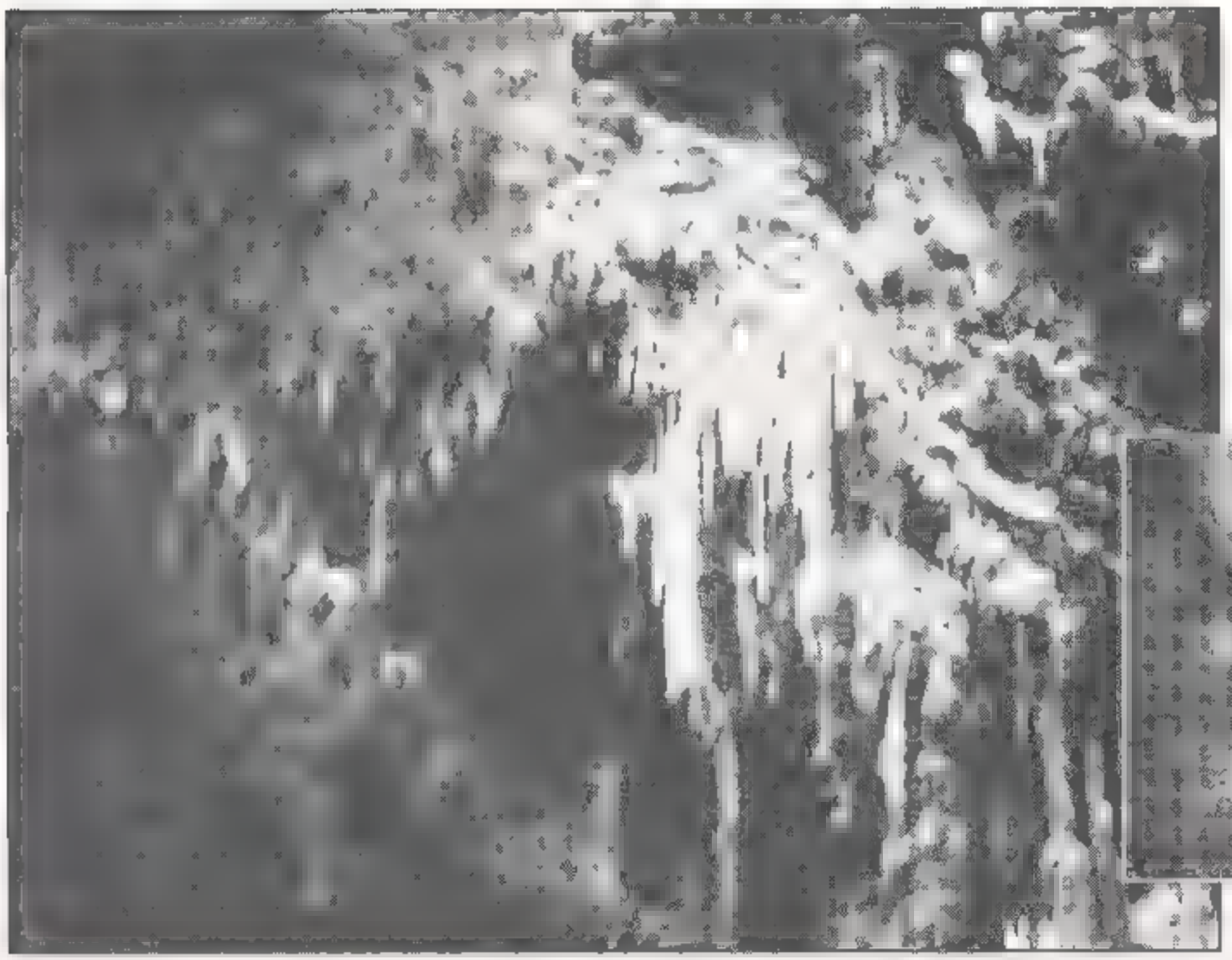
Looking around, I wish I were a lot more useful. The only creature in sight without a definite purpose is Princess, the mine cat. Somewhere on the property, Bob is warming up the bulldozer for his next project, and Dick is making one of a dozen decisions needed to get the whole operation through next week.

The Sterling Hill Mining Museum is one of those extraordinary institutions which is plainly greater than the sum of its parts – even though it has more parts than I can keep track of. It's a tourist attraction with local interest and a preservation project with global value. It's dependent on volunteer help, but requires the full-time attention of one family. Some of the volunteers are average folks and some are highly skilled professionals, and the help of all of them is necessary. The museum attracts $10 donations from some supporters and $40,000 grants from foundations, and every cent of this is necessary also.

Considering Sterling Hill's importance from any angle – historical, educational, cultural, mineralogical, geological – the Haucks can never do enough. Yet whatever they do is more than anyone else could have accomplished. It's truly astonishing.

Go there for the minerals, or the mining artifacts, or the mine, or for all of the above, and you'll find more than enough to engage your attention, and your family's. If you manage to distill the significance of the Sterling Hill Mining Museum down to a single concentrated idea, please let me know, though I doubt you will. Like all great things, it defies categorization.

Beneath The Shenandoah Valley



Discover The Mineral Wonders Of Virginia's Caverns

Luray Caverns' famous Fried Eggs

Spotlight on the delicate wonder of the Oriental Tea Garden

by Sandra Downs

Beneath its surface, Virginia's Shenandoah Valley hides a treasure trove of natural wonders. The karst topography of the valley—limestone riddled with sinkholes—combines with an ample supply of water to form some of the most spectacular caverns in the Eastern United States. Intrepid explorers have found hundreds of caves within this historic valley. Of these, five have been 'domesticated' for the general public as show caves. Their close proximity to each other makes it possible to visit all five over the course of a weekend, and still have time left over to enjoy a segment of Skyline Drive in Shenandoah National Park.

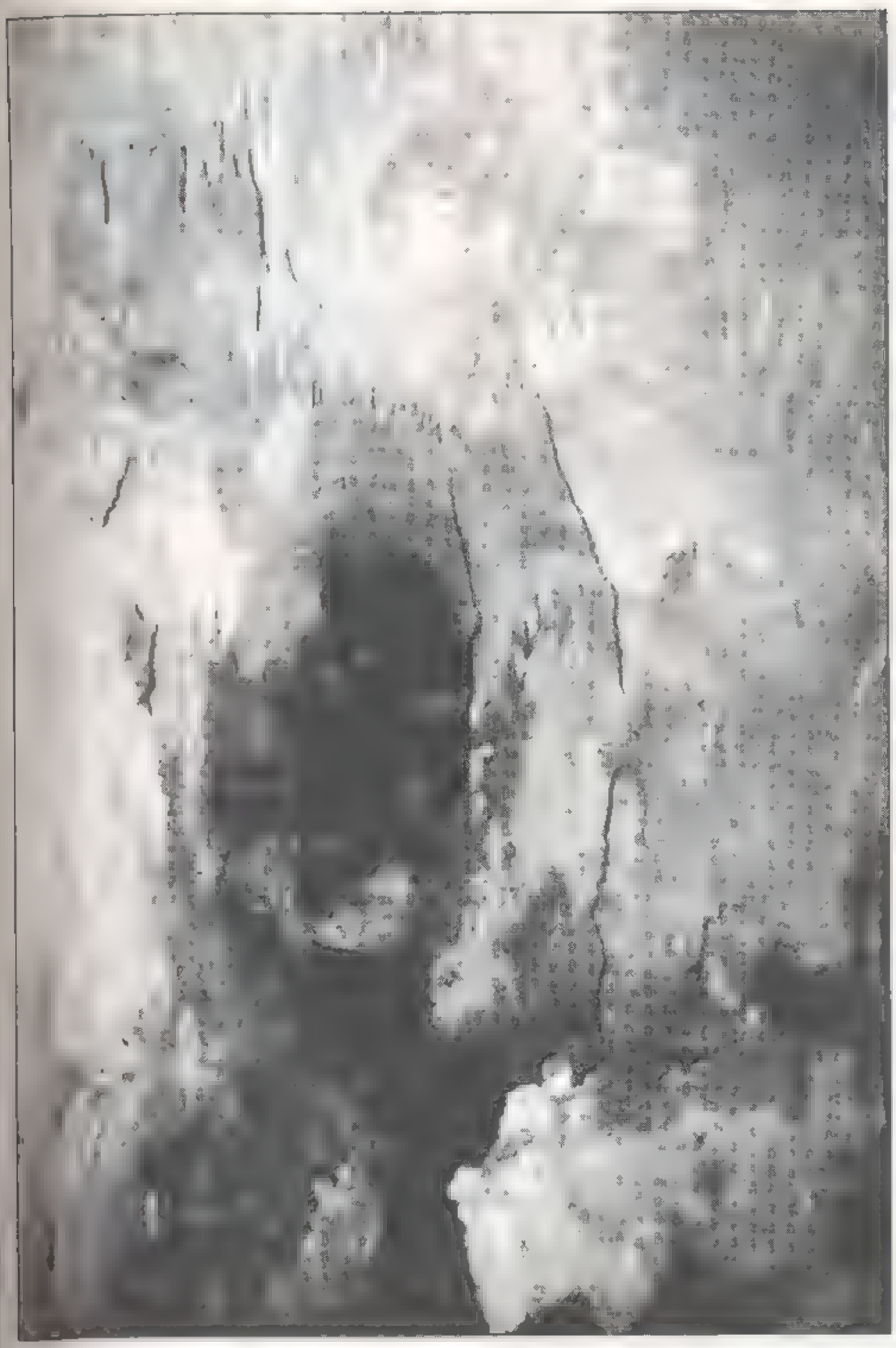
ENDLESS CAVERNS

In 1879, two brothers followed their dog as it chased a rabbit through the Reuben Zirkle's farm, up the side of Massanutten Mountain south of New Market. The rabbit disappeared into a hole, and the boys clawed at the hole trying to get to the rabbit. They broke into a tall, narrow passage under the mountain, which continues to serve as the entrance to this cave system.

Endless Caverns opened as a tourist attraction in 1920, with an imposing log and limestone lodge serving as a restaurant. In those pre-conservation days, the largest underground chambers were used for parties and dancing; one still has a candle chandelier hanging from the ceiling.

Today, tour groups gather at the lodge, which houses the ticket booth, gift shops, and the most comprehensive selection of minerals and fossils found at any of the show cave gift shops in the Shenandoah Valley. The owners obviously enjoy minerals, as the fireplace is flanked with petrified logs and massive specimens that include pyrite on dogtooth calcite.

Of the show-cave tours in the valley, this one comes the closest to feeling like a walk through a wild cave. Floors remain



Conococheague limestone counterpoints the formations at Endless Caverns.

unpaved and are wet and muddy in places. Tubular passageways, carved by stream action, show cave coral along their walls.

The key to understanding the multi-level path of your trek through this cavern is The Crossroads, where tour paths intersect. After passing through this point, the Grand Canyon comes into view. The stalactites and pendants look surreal, like a cavern designed for a theme park. Appearances are deceiving, as the hour-long journey then commences with a steep, slippery descent down into the Grand Canyon to the second level.

In this dry area, bats dangle from every chamber ceiling. Several rare Eastern gray bats haunt the passages, but more common are the large and small brown bats, all of whom seem to prefer clinging to the expanses of dry limestone rather than straying near the active formations. Pendants are the primary formation through this area, and breakdown—massive piles of rock material fallen ages ago—is common. A corridor leads past rimstone dams and limestone sculptures reminiscent of grand mesas and buttes. Alexander's Ballroom, once the scene of many Prohibition era dances, has a cobblestone-like floor and a flowstone backdrop dubbed Weeping Willow Falls. A large erosional formation on the floor is reminiscent of Santa's sleigh.

Below the ballroom is a showpiece of stalactites and stalagmites with a dripping twin column, one of the more photographed features in the cave. A karst window—you can look through it but you can't go through it to reach the other side—reveals a stream running swiftly below on the third level. Rounded shields host small collections of flowstone. The trail winds around columns and large stalagmites. In many larger chambers, streams flow seasonally. Their contributions to the cavern are in the form of rimstone dams as tall as 6 inches.

Eventually, the tour reaches Explorer's Hall, with chambers of pure, sparkling snowy white calcite forming virtual snowdrifts and frozen cascades, cave bacon hanging to the ceiling. Curtis Point, on the Explorer's Trail, is the starting point for experienced cavers to continue to map the caverns. Endless Caverns appears on the *USA Long Cave List* with 5.5 miles of passages mapped as of 1992. At the tour's deepest point, known as The Pit, 145 feet under the earth's surface, a shallow reflecting pool shows off delicate soda straw formations.

After backtracking past Alexander's Ballroom, the tour snakes through chambers showing more features created by watery pools, including lily pads. Beyond the Crossroads, the artificially widened passageway opens up into The Cathedral, the showiest display of stalactites and stalagmites in the cavern. Lights and sound simulate an underground sunrise playing across the expanse of formations. In the final chambers, the unique blue tint of the stalactites and stalagmites comes from the surrounding chalky blue limestone.

Endless Caverns is located along U.S. 11, five minutes south of New Market, Virginia. Use I-81, exit 257 or exit 264. The park is open daily all year, and closed Christmas. The park opens at 9 a.m. and closing hours vary with the season. For more information, call (800) 544-CAVE.

GRAND CAVERNS

The oldest and grandest in the valley, Grand Caverns was discovered by Bernard Weyer in 1804 when he went hunting an opossum. As the first show cave in Virginia, it opened in 1806 and hosted many famous explorers: George Washington, Thomas Jefferson and James Madison among them. A 24-room hotel was built in nearby Grottoes to cater to the early tourist trade. Surviving the Civil War, the chambers pay homage to the men who took a break from the battlefield to take a candle in hand and delve underground for six to eight hours with a guide. On close inspection of dry surfaces, many of their signatures can be identified.

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In 1889 Grand Caverns guests no longer had to use candlelight thanks to an experimental installation of electricity by George Westinghouse

The caverns are one of three caves in Cave Hill, a part of the Virginia Regional Parks system. Grand Caverns is the only one open to the public. Its large shop includes a healthy dose of the history associated with Cave Hill and displays many modern speleothems: iron oxide stained dogtooth calcite clusters, cave coral, gypsum flowers, soda straws showing the initial growth spurt of stalactites. Mineral collectors can find some basic specimens for the kids.

On entering the caverns, the most noticeable feature is the unusual vertical bedding of the limestone. Massive slabs were tilted, creating an odd palette for nature's brushworks. Shields, a more uncommon type of formation, are prevalent in this cave. Over 200 large shields have been identified. Formations are apparently unusually spaced to dive deep under the ground for the first eyeful of stalactites, stalagmites and flowstone dripping from shields. Guides point out the original ceiling which would slightly up and down slopes. It would be deemed dangerous by today's standards. The cave is quite active; the sound of dripping water sounds almost like a downpour in the echoing alcoves. Beyond the first few chambers, the cave opens up tremendously, and the grand nature of its massive chambers becomes evident after the tour.

In the Persian Palace, flowstone curtains resemble cheese dripping from an inverted pizza. High above the Armory, the Army shield looks like a gigantic potato chip stuck to the ceiling. The Grand Ballroom, host of many a major dance in 1839, has over 5,000 square feet of floor space. Natural shelves served as seats and ballet space. Couples would retreat to the secluded Love's Lane passage for privacy.

Beyond, a set of stairs leads down through the Stalwater Pool, where cave coral and rimstone shows the water levels as the water dropped through the chamber. The low passage which drained the pool today is home to hundreds of small rugs of dogtooth calcite. Dante's Inferno glows in the distance, a former part of the tour where visitors' candles would mysteriously snuff out. After a squeeze through a narrow tunnel, guests were amazed by the expansive, endlessly long Cathedral Hall. Flowcastles, a large stone totem pole rising glistening white calcite, named Washington's Ghost. Inside adjoining Martha Washington's Dressing Room, white helictites, sprouting delicately fries, dangle in front of cave bacon. Shields and columns, beginning with shields, become commonplace.

The Tower of Babel, 80 feet high, looks like a massive waterfall stone. The cave-

The Wishing Well at Luray Caverns is the most profitable in the world. Over $400,000 in coins have been collected since the 1950s, and given to various charities.

ern's trademark formation is in the chamber at the farthest point on the tour, the Bridal Veil. The adjoining room contains two shields that form an enormous vertical oyster shell. While backtracking on this tour is a necessity, the hour-long tour is dazzling in its amazing quantity and diversity of shield formations.

Grand Caverns is located on Grottoes, Virginia, off exit 235 on I-81. Follow VA 256 to Grottoes, and watch the signs for the two right turns leading off VA 256 and into the park property. The hours are 9 a.m. to 5 p.m. on weekends in March and daily April through October. For more information, call (540) 896-2283.

LURAY CAVERNS

At the time Luray Caverns was discovered, the United States was caught in "cavern frenzy." Many brave and foolhardy souls dug deep into sinkhole-type ground, looking for the next big tourist attraction that could cash in on the splendors of Kentucky's Mammoth Cave. Luray was the result of such a business effort. The caverns were found by three local men in 1878, within a few months they opened to the public. Journalists' reports of the colossal cavern brought tourists by the tramload.

Luray Caverns' allure comes from its gigantic formations and huge chambers. Its paved path with railings is handicap accessible. The constant drip in the Amphitheater reminds visitors that the cave is very much alive. Tours first pass Formation Row, which showcases stalactites, stalagmites and columns vividly colored by iron oxide and manganese. Below a natural bridge is the Fish Market with gray flowstone dripping like fresh fish. Dream Lake, a 2,500-square-foot pool of water ranging from 2 to 18 inches deep, creates a perfect mirrored reflection of the stalactites above in its pure water.

The largest chamber, Paradise Chasm, is over 500 feet long and up to 90 feet deep. Around its edges are immense draperies and thousands of stalactites and stalag-

ites. In its center stands Pluto's Ghost, a white calcite stalagmite that is seen from three angles along the tour route. Four cascades compete with a close-up view of tiny rimstone dams. The Overlook Chamber elicits wows from visitors, who take in the Giant Redwood Tree, a 120-foot-wide flowstone, and a sweeping view of the tall totem poles in Giant's Hall. Solomon's Veil, a gigantic drapery, hangs over the path. Below, in Giant's Hall, is a 47-foot-tall double column.

The massive sizes of formations are so incredible that it's easy to miss small wonders, like soda straws clustering above in a high ceiling, incredibly thin strips of cave bacon, and a wispy species of helictite, hair-shaped helictite hovering near the Bridal Veil hammer of the Stalacpipe Organ. Colored lights are few, the natural exception being the glow of the Wishing Well. Passages wind past a dizzying array of stalactites and stalagmites, and across flowstone. Guides point out the famous Fried Eggs, created by the natural capping of broken stalagmites.

Back on the surface, there's an absorbing car and carriage museum included in the admission price, and a large variety of shops. From the front porch of the main building is an expansive view of Blue Ridge.

Luray Caverns is located on U.S. 211 in Luray, Virginia, 15 minutes east of I-81 exit 264 at New Market. Open daily, seasonal hours start at 9 a.m. For more information, call (540) 743-6551 or visit the Web site at www.luraycaverns.com.

SHENANDOAH CAVERNS

Discovered in 1884 by construction workers on the Southern Railway, Shenandoah Caverns opened to the public in 1922. A vintage elevator complements the long staircase into the cavern. The rolling tour is fairly level and handicap accessible, many of the passageways are long and wide.

Cave bacon, up to 6 feet long, is the showcase formation in these caverns. The caverns extend over three levels, two of which are part of the tour. Bats freely roost in the chambers of eight species. The Garden of the Gods contains amazingly tall walls of vivid white flowstone. Colored lights enhance some areas, such as the Oriental Tea Garden and Beyond the Veil; a wonderful collection of delicate soda straws. Cave bacon hangs somewhere in nearly every large chamber. In the 70-foot-tall Cathedral Room, active rimstone dams flank one wall. A stalactite and stalagmite are only one drop away from becoming a column. The shadowy Bishop looks in the distance.

Beyond, the Diamond Cascade sparkles like glitter, the flowstone surface flecked with pure calcite, and two shields side-by-side in a corner. The 22-ton Leaning Tower is a column which shifted during an earth-

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Shenandoah/ *from page 37*

quake an estimated 7,000 years ago. In the Giant's Room, visitors can peer under a 300 ton boulder which rests on only three small points above the trail, not touching any of the walls.

Climbing up to the drier first level, you can see the difference between active formations and actively deteriorating shields and stalagmites. The ceilings show packer marks from the flow of water through these rooms. In the Whirlpool Room, a lone stalactite bent into a corkscrew dominates the ceiling. Cardross Castle is a collection of totem poles huddled close together. A tight squeeze through Tall Man's Headache leads to Rainbow Lake, a reflection pool shimmering in colored lights. After backtracking to the second level, guests visit the snowy white, twinkling Capitol Dome.

Admission includes a walk through exhibit and American Celebrations on Parade, which shows off moving figurines from parade floats designed by the caverns' owner, Earl C. Hargrove, whose collection dates back to 1949.

Shenandoah Caverns is located one mile west of exit 269 on I-81, north of New Market, Virginia. Shenandoah is open daily, all year. For more information, call (540), 477-3115.

SKYLINE CAVERNS

Discovered in 1937 by Walter S. Amos, a retired geologist, Skyline Caverns contains an amazing geological find: anthodites. A form of helictites, these rare mineral flowers—aragonite with calcite tips—formed in a vacuum-sealed chamber 260 feet below the surface. The chamber is at the deepest point of the tour, which starts off at the original entrance, a stakhouse dug where Amos and his scouting party tracked down cave crickets, common cave dwellers in the region.

The winding water-carved limestone passageways are punctuated by groups of formations, primarily in the ceiling joints. Calcite ledges show the fall of water eons. A snowy Capitol Dome rises above a natural bridge. Active flowstone forms a Frozen Niagara. Three streams actively meander through the passages, one with a 37 foot waterfall to a lower level. A small trout pond contains fish. From Formation Row, where stalactites decorate the ceiling, guests can peer through a karst window to a lower level. Cathedral Hall contains massive draperies in the shape of an eagle, and the exiting passage gives sharp-eyed visitors their first glimpse of aragonite needles growing high on the ceiling. After emerging back at the trout pond, visitors watch lights play across the mirrored surface of Fairy Land Lake. Here puffs of aragonite needles crowd portions of the low ceiling, a miniature delight.

The passage leads down to the anthodite chamber, where mineral aficionados will gasp in awe. Feathery white spikes grow out in all directions from anchor points on the roof of the chamber. In some places, the view is marred by chicken wire—a necessary precaution to protect the delicate and rare formations from vandalism. Their growth rate has been estimated at 1 inch per 7,000 years, one of the slowest forming mineral deposits known to man. Since the chamber was discovered and the vacuum seal broken, the formations have stopped growing. In the 61 Room, the deepest point of the cave, the anthodites cover the walls and ceiling.

Exiting the cavern, guests pass by a gushing stream where staff members continue to plumb the depths of the cave. Blind crayfish and cave fish ply these waters, where the only known specimens of the Valentine beetle—all dead—were discovered. Back at the surface, numerous gift shops, a snack bar, and a miniature train for kids round out the experience.

Skyline Caverns is located off I-66 at exit 6, Front Royal, Virginia. Follow U.S. 340 south. The caverns on the right are less than a mile past the entrance to Skyline Drive. The park is open daily, all year. Call (800) 296-4545 for more information.

SPOTTING SPELEOTHEMS: WHAT'S THAT FORMATION?

Cave coral (cave popcorn), knobs of calcite growing from joints in the cave wall.

Cave bacon: thin draperies of iron-oxide stained calcite that look like strips of bacon.

Cave pearls: small spherical bodies of calcite; forms in depressions in flowing water.

Canopies: unsupported hanging deposits.

Column: when stalactite and stalagmite meet to stretch from floor to ceiling.

Drapery: thin, translucent sheets of calcite that dangle from cave ceilings or shields.

Flowstone: sheets of calcite laid down by flowing water.

Helictite: stalactite formed by seepage, grows in a curving, irregular shape.

Lily pad: thin, rounded shelves of calcite which once rested on a calm pool of water.

Pendants: unsupported hanging erosional features.

Rimstone: dams formed by running water leaving a growing calcite deposition in one spot.

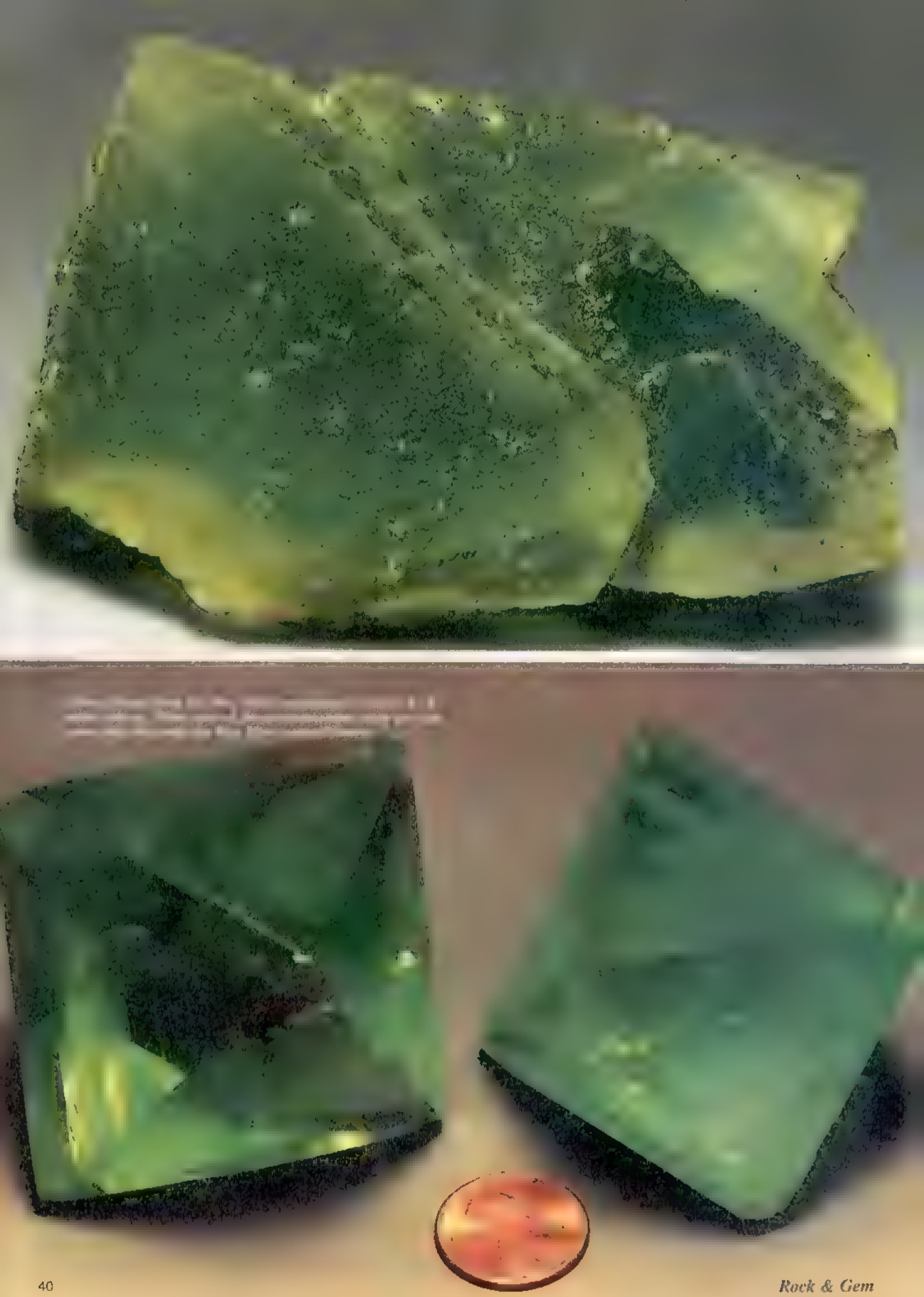
Shield: two parallel plates of calcite separated by a planar fracture.

Soda straw: a tubular, hollow stalactite.

Stalactite: mineral deposition that grows down from the cave ceiling, can be cone or tube shaped.

Stalagmite: mineral deposition that grows up from the cave floor, can be cone or tube shaped.

Totem pole: stalagmite that is thicker at the top than at the base.



Wise Fluorite

This New Hampshire Mine Is A Favorite Site For Eastern Collectors

by Ken Hollmann

Famous for its fine green fluorite, the William Wise Mine of Westmoreland, New Hampshire, has been a favorite site of generations of New England collectors. Located in the southwest corner of the state about 10 miles due west of Keene, it is the northernmost of a group of mines straddling the Westmoreland/Chesterfield town line.

The area has been a known source of fluorite since the early 1800s, but the material was not mined commercially until the end of that century. Parker Cleaveland's *Elementary Treatise on Mineralogy and Geology* (1822) lists light green "fluate of lime" (the old trade name for fluorite) as coming from Westmoreland. The Wise Mine, discovered in the late 1890s, was worked sporadically until about 1919. Other properties in the area were active until the late 1930s. Between 1911 and 1938, shipments from all mines amounted to 7,500 short tons, with the greatest production occurring in 1917-18.

The Wise Mine and others in the group are located near the contact of the Oliverian gneisses and Ammonoosuc Volcanics. Quartz-fluorite veins exhibiting a comb structure with distinct banding were deposited along preexisting faults having a NNE strike. Quartz was the first to form on the walls, followed by fluorite and minor amounts of barite and sulfides.

In spite of the water, miners search diligently for fluorite at the Wise Mine

The Wise is the only mine in the district to produce the splendid deep green, often flawless crystals that are in such high demand by mineral and gem collectors. In *Gemstones of North America*, John Sinkankas states, "The color is exceptionally pure and rich, and is reminiscent of the hue of emerald. The beauty of this material has no peer in North America, and is rarely excelled elsewhere." Other experts consider it the best material of its kind worldwide.

There are two generations of fluorite found at the Wise, either separately or in combination. The first generation is characterized as deep green, unmodified octahedra, sometimes having a bluish cast. The second generation is light-green to pale blue and colorless, in the form of octahedra often with cube modifications.

Studies have shown that fluorite crystallizes as octahedra at higher temperatures, but as the temperature of formation drops, the habit changes to cubes. Many of the deep-green crystals are completely enclosed by the later generation fluorite, giving them a rough, stepped surface. Others are only partially coated, resulting in very striking specimens. Under short- and long-wave ultraviolet radiation, the fluorite fluoresces blue, the darker-green material having the strongest response. It is not known for certain which activator is responsible for the fluorescence, but recent analysis has shown yttrium to be, by far, the major rare earth element present. The fluorite's beautiful green color is also thought to be caused by yttrium.

Most early collecting efforts at the Wise entailed working the dumps. In 1967, John Marshall of Massachusetts decided to revisit the locale after having long admired a choice piece in his cabinet that he had collected in the late '40s. John's initial efforts were encouraging. On his fourth visit, he was joined by fellow collector, Shields Flynn. Their hard work resulted in some spectacular pieces weighing up to 76 pounds. An excellent account of their finds appeared in the March 1969 issue of *Rocks and Minerals*.

continued on next page

Portuguese-cut fluorite by Bob Borofsky. 125 carats.

Wise Fluorite/ *from page 41*

In 1988, the Resurrection Mining Company leased the property and worked the vein for specimens. Many fine pieces were recovered, one of which appeared on the cover of the July/August 1990 *Rocks and Minerals*, an issue dedicated to New Hampshire. Many years ago the local people used the fluorite to make novelty curtain pulls and five-point stars constructed of cemented cleavages, on rare occasions these curiosities can be found at yard and estate sales.

The last time I had been to the Wise Mine was nearly 30 years ago when, as a neophyte collector, I spent many hours eagerly digging through the overgrown dumps. Great care was taken in wrapping my finds so they would arrive back home in Vermont intact (which they did), but when I later cleaned them I made the unfortunate mistake of using hot water. As I quickly discovered from the snaps and pops emanating from the specimens, fluorite is very heat sensitive. I easily doubled the number of pieces I started with.

Presently the mine is owned and operated by Robert Borofsky and James Tovey under JoLynne Associates Inc. Since they both have other regular professions, they work the mine when time allows, usually for a couple weeks at a stretch, two or three times a year. Sale of specimens helps offset the high operating costs, the lease of the excavator alone runs into many thousands of dollars per season.

The area Bob and John decided to work is farther north on the vein than any previous efforts. Initially, they attempted to locate pockets using high-tech ground-penetrating radar (GPR) mapping, but at the time, that did not prove successful. Later comparison of that data with actual pockets found showed correlations. Now that the GPR signals can be better interpreted, that technique should be more effective if used in the future.

In October 1997, I visited the operation and was given a tour and history of the mine. I asked Bob how the name "JoLynne Associates" originated and was told it stood for their wives' first names.

"Now when we go off collecting," Bob quipped, "we tell them we are going to 'their' mine."

North along the vein where they were working, Bob pointed out an area about midway up a 40 foot face where they hit their big pocket in November 1994. That one measured 14 feet high by 3 feet wide by 2 feet deep, with the best specimen going to the Smithsonian Institution. Many of the pockets are filled with a clay which is effectively removed by using a portable high-pressure washer, revealing the crystals within.

The largest crystal found thus far came out in 1996, and measures 12 inches on edge intergrown with another of 8 inches. That particular piece is presently on display at the library at Keene State College, along with other choice specimens from the mine. The biggest group ever recovered is 2 feet across and weighs over 100 pounds.

From clear pieces of the darker green fluorite, many fine stones have been faceted. Since fluorite is so soft, having a hardness of only 4, it is not durable enough to be worn in jewelry, but because of its outstanding color, it is desired by collectors of unusual and rare faceted stones. The largest flawless one known weighs 468 carats and belongs to a private collection.

Another collectible mineral from the Wise is quartz, usually milky or clear, but at times light smoky. Sceptered crystals are not uncommon and may reach 2 inches in length. Most of the quartz is lightly etched, but last fall a pocket produced groups of clear, glassy crystals, some sceptered, having an unusual spoked smoky zoning at the termination facial junctions, giving them an asterisk-like appearance when viewed down the C-axis. To top it off, a terminal face on one crystal enclosed a inch liquid cavity containing a movable bubble -a super specimen for any quartz collector!

Another great piece mined last fall was a 4" inch fluorite octahedron with a crest of sceptered quartz crystals. An unusual piece in Bob's collection is a small bristling mound of delicate, elongated quartz crystals that reminded me of an irate porcupine. Other desirable quartz specimens are those having fluorite in association, especially with isolated deep-green octahedra perched on the quartz crystals.

The Wise Mine is not open to collectors, with the exception of the Keene Mineral Club, which is permitted to collect on certain dates. For membership information write to: Keene Mineral Club, 12 Partridgeberry Lane W. Swanzey, NH 03469.

For those interested in obtaining Wise Mine specimens, facet rough or cut stones, write to JoLynne Associates Inc., 363 Scoby Rd. Francestown, NH 03043, or call (603) 547-6805. Jo and Bob will be at the big East Coast Gem, Mineral & Fossil show in Springfield, Massachusetts, this Aug. 7 - 9. They'll have plenty of material available along with a display case highlighting recently mined specimens. Another special display will show off a Wise fluorite "old timer" from the Pratt Museum Collection at Amherst College. The show theme this year will be Southern Illinois/Kentucky fluorites with over 40 display cases full of specimens from three private collections as well as the Harvard Collection.

If you like fluorite, you won't want to miss this show!

The BERRY MINE Rediscovered

Fluorapatite And Tourmaline Bounty From A Forgotten Farm In Maine

Working the Berry Mine (above). Breaking into the second chamber (below). Tourmaline specimens recovered from the second chamber (bottom).

by Stephen & Jason Welsh

The Mount Apatite area in Auburn, Maine has long been known to experienced mineral collectors throughout the world. This area has been a prolific producer of gem tourmaline and fluorapatite crystals. Many rare phosphate minerals are known from the Mount Apatite area, especially the western complex of mines.

The Mount Apatite area was first developed on its southwestern flank by those in search of quartz and feldspar at the Turner Mine and its immediate neighbor, the Hatch Ledge Mine. This development began in the late 1800s. The western complex of mines had already begun to produce fine tourmaline and other minerals when the eastern complex was being developed. The eastern complex, infamous for feldspar production without regard to minerals, includes the Maine Feldspar Q, Smith Q and Greenlaw Q. The Maine Feldspar Company, which was directed in the Auburn area by Forest Havey, instructed miners not to stop for pockets, but to "blow them out of the way and keep going."

Every knowledgeable collector knows of the large pocket of blue tourmaline that was blown up in the Greenlaw. The sky showered thousands of crystals onto the miners after the blast. Some fine rich blue crystals were recovered and locally referred to as Alice Blue. Most were scattered to the wind. Some present at the time estimated that it could have been one of the largest pockets in Mount Apatite history, had it been carefully approached. This is why so much material is found today in the area controlled by the city.

The western complex, unlike the eastern complex, is still operating with excellent results. The mines are still producing beautiful apatites, tourmaline and quartz crystals. Honest collectors who have secured permission and visitors to the Poland Mining Camps have found other things recently in the western complex, like large well-formed gahnite crystals, gem garnets, green elbaite wrapped in purple apatite, and topaz.

Sitting patiently in the shadow of the grand and better known Mount Apatite another location has been long-forgotten, waiting to regain the magnificence and fame it once had at the turn of the century. This location sits about two miles south and across the little Androscoggin River. It is known by several names. The Berry Gem Mine, The Emma Berry Mine, Berry's Ledge and the Berry Havey Mine.

The Berry Mine is located in the town of East Poland, Maine. Mr. Berry had seen the activity on the nearby Mount Apatite and thought the ledge on his old farm might have the potential to produce paying quantities of quartz and feldspar. He developed the location in 1896 for the accumulation of quartz which he sent to the Portland Mineral Company in Portland, Maine, for crushing. The mine was operated solely for the recovery of quartz by Berry, with occasional help from the Mills brothers of Massachusetts, until 1902.

continued on next page

Berry Mine/ *from page 53*

The main focus of the operation as time went on was the recovery of graphic granite. The mine was operated completely by hand drilling, hand loading materials onto wagons and hauling the materials several miles to the mill at Littlefields' Tavern. Occasionally Berry would come across pockets of pink and green tourmaline in the course of his work. He also found minor pockets of hydroxyl herderite and quartz and uncovered a yellow beryl crystal that measured 6 feet in diameter. He sold these materials locally with Mr. Turner of the Turner Mine on Mount Apatite. Unfortunately, no specimens are known in collections that can be determined to have specifically come from Berry's operations. After closing in the early '20s, the mine sat untouched for the better part of the century.

In the fall of 1994, I, Stephen Welsh, leased the location and began an investigation of the mine with no idea how exciting my hobby was about to become.

At first, the view of the pit was completely obscured by waste materials. The walls were covered with steep slopes of tailings, the floor was covered with a layer of mud and rotten vegetation over 3-feet thick, and a great amount of water had settled in the bottom of the pit. Only a minor amount of the ledge areas that were mined had ever been seen by any living person other than Berry.

With a skid steer, I began to investigate areas of the pit in 1995. The skid steer allowed me to investigate a couple of different ledge areas that were above the waterline but covered with a thick layer of tailings and muck. One area that I uncovered had a small square of lepidolite and hundreds of pale-yellow beryl crystals. After a blast or two, a small pocket of indicolite was revealed — just as the snowy Maine winter arrived.

When spring arrived I procured the use of an excavator, a dump truck and the assistance of Randy Stone. I set in for another year of prospecting.

A cut through the ledge about 10-feet wide sparked my curiosity as the lepidolite and small tourmaline pockets from the previous year were at one end. This cut appeared to be only about 3-feet deep. We set in to take a day to clean it out with the equipment. At the end of three weeks and after the removal of a lot of material, the cut was fairly cleaned out and washing set in. The only result was a single, rich pink morganite crystal embedded in deep green muscovite.

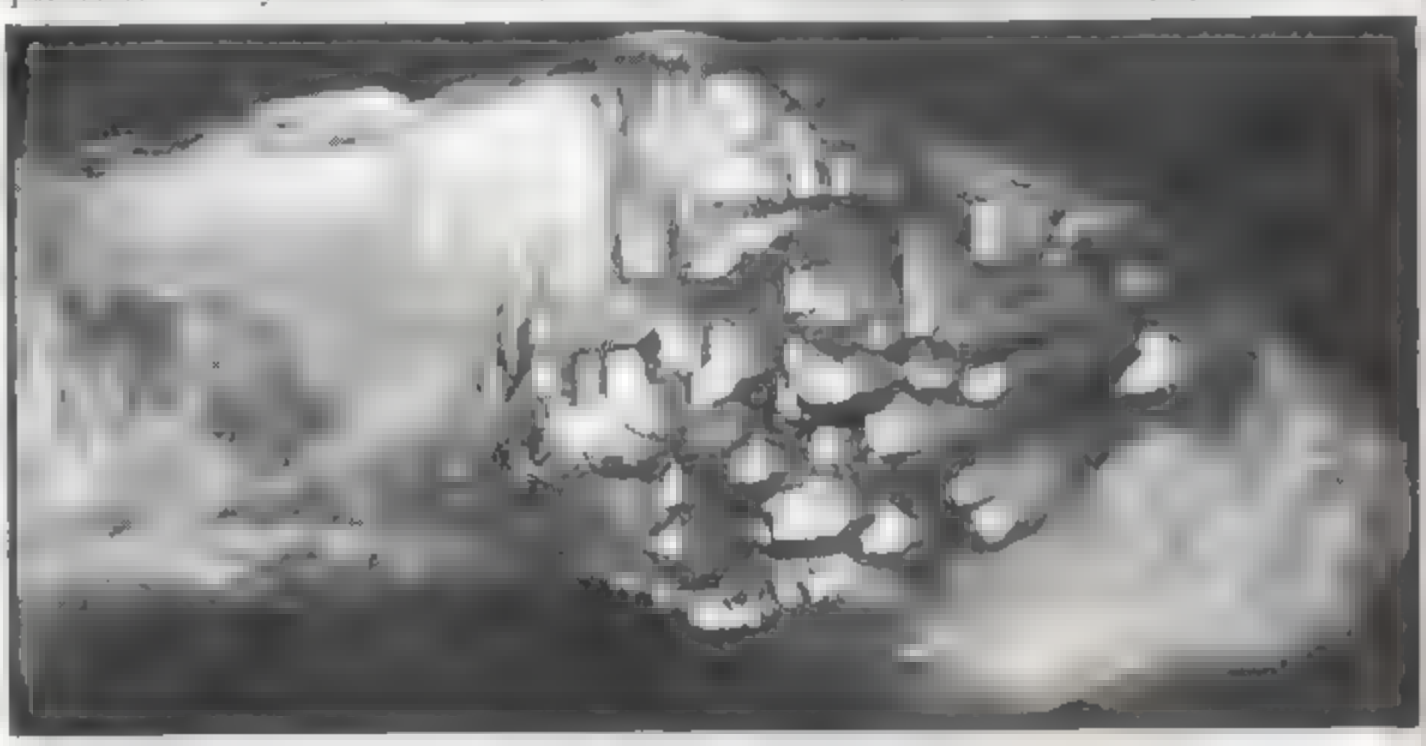
I decided to pull off some of the loose ledge on the outside of the cut and try to clean out the area before leaving that day. As I had pulling at the ledge with a powerful excavator, I noticed a chunk of rock covered with 1- to 2-foot long blue tourmalines. Jumping from the excavator to look closer, I saw three 3-inch by 8-inch tricolored tourmaline crystals in plain view.

As I backhoed out some of the water to get a better view, I saw a small hole in the ledge. It was hard to define the hole exactly, due to the presence of water, but I could see that it was encircled with cleavelandite. Randy and I scraped back the loose material around the area and began washing the ledge off. As we did, we began to notice a white powder in the water and some large muscovite crystals. Then a chunk of cookeite appeared. This was the sign that all was to stop and attention was now to be focused on the water filled area.

The water was emptied from the area. The remaining crater revealed itself as an old pocket while part of what was left had been hit with the water and lost in the surrounding mud. More investigation of this area revealed another chamber about the size of two cupped hands. It was packed from wall to wall with fine blue green tourmaline crystals the size of a man's finger.

The next day, another chamber was revealed. The third chamber was the largest pocket in this area (about 12 inches by 28 inches), but the fine crystals were much thinner than those in the previous two chambers, which were about — inch by 6 inches in size. In this chamber, the crystals were lying throughout the soft kaolin instead of on the bottom of the pocket, as is commonly the case. It did offer a few surprises, such as a rubellite terminated blue-green tourmaline, many watermelon crystals, a large terminated crystal and some pink tipped blue green tourmaline. This pocket was named the Mother's Day Pocket, as that was the day it was discovered.

Due to problems with equipment, the first



...ses surrounding adventure took place ... the spring of 1997. The mineralization re... ...ng of the Mother's Day Pocket had dis... ...ed so that the area had to be opened ... ...hopes of revealing a new direction to ... ...explore. The cut was expanded more than ... ...in all directions. The drilling alone ... ...took two weeks and revealed nothing. I un... ...covered the area for another week, poking ... ...for other signs. Eventually, I began ... ...to open the area again, dropping the floor ... ...and deepening the pit farther in all directions ... ...as I mined and I found nothing.

...ut, near the end of the cut, another ... ...blast was put in. We walked down and ... ...looked. Nothing. We scurried down into the ... ...pit to poke around before going home. We ... ...found a large area of broken quartz. It ap... ...peared as if there was a 5-foot-by-4-foot re... ...cumbent block. Then we saw some quartz ... ...crystals. We began to pluck the large smoky ... ...crystals from the soft, white lining of the ... ...pocket. Some were very fine, intact crystals ... ...with beautiful parallel growth. Many were ... ...broken.

The following day, we entered the cham... ...ber proper. We removed quartz crystal after ... ...quartz crystal. There were some minor tour... ...maline crystals present that added to the ... ...pocket. After two weeks of cleaning out, ...unpacked, we were at what appeared to be ... ...the bottom. The pocket was covered with ... ...old pound blasting mats and we rested. ... ...The quartz crystals, some up to 60 pounds ... ...or many, hydroxyl-herderites coating the ... ...faces. We would back about a week later to ... ...see what few quartz crystals may have ... ...grown.

After working six or seven hours with a ... ...backhoe, it was agreed that the pocket was ... ...empty. About 100 carats of rough gem ... ...material had been discovered, which is ... ...disappointing, considering old-timers say that ... ...when any herderite is not usually found with ... ...pocket crystals of tourmaline.

After Randy left, I decided to stay for a ... ...while before packing up. I picked around ... ...for an hour or so without any results. I pen... ...etrated a small spot showing a whirl of rot... ...ten green tourmaline in the middle of some ... ...milky quartz. Similar spots found before ... ...had turned out to be trash. But a side of the ... ...pocket presented a green tourmaline, and ... ...then it continued to appear. All helpers ... ...left their jobs and raced to the mine from ... ...points all over southern Maine.

The crystals discovered were the size of ... ...a man's middle finger or smaller. Buckets ... ...were filled with tourmaline frozen in ... ...concrete off and on for three more weeks as ... ...the pocket was developed. The floor and ... ...walls were expanded as the tourmalines ... ...suddenly seemed to come from everywhere. ... ...About 6 buckets were filled with material ... ...from the pocket, which yielded over 15 ... ...pounds of clean terminated tourmaline crys... ...tals. About 8,000 carats of the finest green ... ...were separated for cutting.

The pocket was about 4 feet by 3 feet by ... ...3 feet when it was cleaned out, at which ... ...point its formation became obvious. The pocket formed with large quartz crystals on the roof and the long green tourmalines laid in soft kaolinite. As time went on, the pink tourmaline centers of the watermelon types dissolved away. Most of these hollow tourmalines were filled with kaolin. The kaolin then disappeared. The tourmaline was then wrapped in cookeite and then the roof of the pocket collapsed. While the cookeite was surrounding and breaking the tourmaline crystals, hydroxyl-herderites were forming in the pocket. Some of these hydroxyl herderites were found growing on the crystal faces of elbaites.

This was to be one of the largest recorded pockets in the history of the eastern United States. What made the find even more rewarding was that so many people had said that the place never produced anything and never would. Some even called it the "Barren-Havey," the Havey being an adjoining pit worked by Forest Havey and George Howe to depletion between 1902 and 1912. Everyone found out this was not true on the undeveloped Berry property. In a letter, the Maine Geological Survey, which had representatives at the mine, called this find one of the most significant in recent history.

The area was played with a bit during the summer months, dug clean with shovels and then washed to expose the ledge. Later in the summer, the area was cleaned off and a thin vein of quartz, lepidolite and pink and blue montebrassite was revealed near the big pocket. Montebrasite is always a good indicator of a pocket.

I sat down with a hammer and chisel to break out a 1-foot by 1½-foot pink montebrassite crystal. As it was freed from the ledge, a broken smoky quartz crystal appeared, followed by tourmaline, then more quartz. This developed into a 1-foot-wide by 2-foot-deep-by-3-foot-long pocket of green tourmaline and a few minor pink pieces. Nearly 5 pounds of all qualities of tourmalines were removed from this chamber.

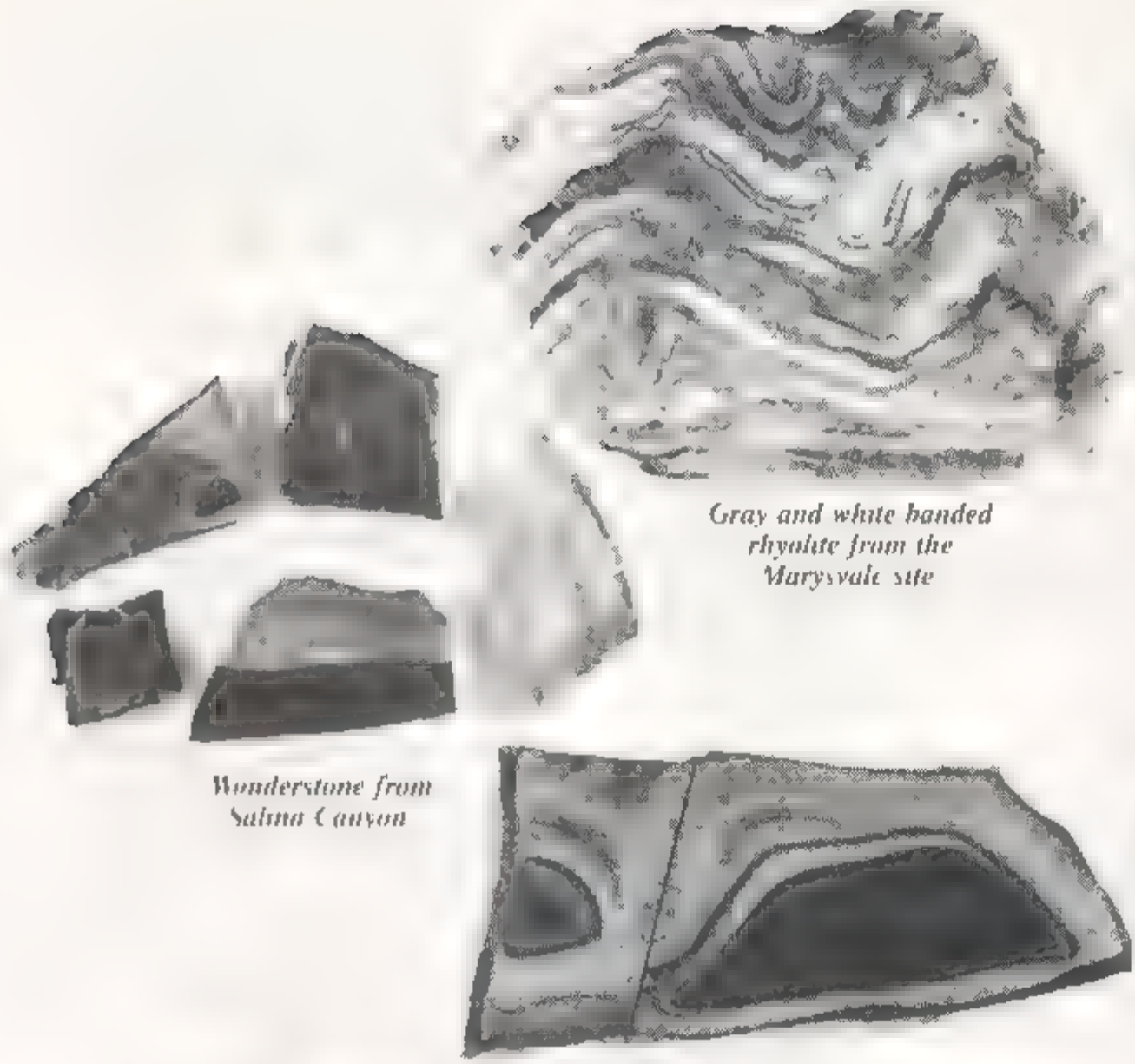
After this chamber was exhausted, the area around the pocket was again investigated, but did not reveal anything of note. Time will tell whether there is any more material to be found. In the meantime, I certainly have had a rare pleasure most can only dream of.

Materials from this locale are occasionally sold to Mt. Mann Jewelers of Bethel, Maine; R. D. Allen Jewelers of Freeport, Maine, and The Rockport Trading Company of Rockport, Maine.

Jason Welsh and I welcome insured federation clubs to write for information if they are interested in visiting. We suggest that people, especially individuals, consider gaining admittance through Poland Mining Camps, which has access to many closed tourmaline locations in nearby towns. Poland Mining Camps also provides meals and lodging for those who make reservations. Write to Poland Mining Camps at P.O. Box 26, Route 26, Poland, Maine 04274.

Four Productive Rockhound Sites In Utah

by William A. Kappele



Gray and white banded rhyolite from the Marysvale site

Wonderstone from Salina Canyon

Agate and barite from the Last Chance Road site.

Salina Utah makes a nice starting point for trips to many collecting sites. Of course if you are driving along Interstate 15 somewhere between Riverside, California, and Alberta, Canada and you find yourself in the middle of Utah, just take exit 202 to the Yuba Lake site and stretch your legs. Or maybe you turned off I-15 onto I-70 and are heading for Baltimore, Maryland. You have over 2,000 miles of concrete and blacktop to share with 18-wheelers before you reach your destination. Why not do a little dirt road driving in peace and quiet along Last Chance Road, and pick up some agate and barite before you face the ordeal. Maybe your travel plans aren't quite so ambitious. You may just be tooling along U.S. Highway 89, one of Utah's two major north-south highways (and my personal favorite), enjoying a generally uncrowded road and lots of pretty little towns. Try the Marysvale site and pick up some showy banded

Out From

[illegible] under a mile off the highway. [illegible] crisp fall day, what could be [illegible]. Family of you are just in Salina for a [illegible] of anvil salesmen, you can [illegible] to Salina Canyon and try for [illegible] of the wonderstone

Yuba Lake

[illegible] at Yuba Lake is similar to [illegible] famous old quarry at [illegible]. Joes not take nearly as fine [illegible] it makes nice specimens, [illegible] is an abundance of the weath- [illegible] eyes. These range from [illegible] golf ball size and make inter- [illegible] displays when cut [illegible] middle. You can find the eyes [illegible] material that can be slabbed [illegible] the hillsides without any trouble. [illegible] have to hike for miles, or climb Mount Everest to get at the material, but, [illegible] walking usually pays off [illegible] stuff.

[illegible] the Yuba Lake site from Salina, [illegible] east on U.S. 50 for about 35 [illegible] the Interstate 15 freeway at Scipio. [illegible] north on I-15 for 14 miles to exit [illegible]. Drive 1.5 miles east toward the lake. [illegible] you will see a road going [illegible] the lake on the left, and an off- [illegible] vehicle road going right. Take the [illegible] that is as far as you can toward the red [illegible] Park and search on the hill- [illegible] for the bird's eye rhyolite.

Last Chance Road

Cora and I found this site more or less by accident. It might have been chance, though, but not our last. We were following some old directions which I had had around for years. They were sketchy at best, but we thought we would give them a try. We found the turnoff from the interstate without trouble, since they are not plentiful out here. After that, it was sort of hit or miss. When we thought we were about at the right place, we were winding down through a little canyon. It didn't look too promising, but we pulled over and parked and wandered around a bit.

We found a few pieces of agate, but no motherlode. We continued on down the canyon, doing the same thing and having the same luck. We didn't seem to be making any headway, so we decided to backtrack a bit. When we came up out of the canyon, we spotted a large playa on the right. It looked like it might just have a rock or two in it, so we pulled in and drove toward a saddle to the south. When we got to about the middle of the playa, we parked and got out to look around. Well, I don't know if this is what our directions were talking about or not, but we weren't about to argue. As far as we could see in all directions there was the sparkle of agate. It was virtually impossible to take a step without putting a foot on some colorful agate. Most of it was small, but there was plenty for 30x40 cabs. The color was great and there was a plus.

Scattered in with the agate were some nice little gray banded balls. Most were about the size of marbles, but many were golf-ball size or larger. We didn't walk over the saddle to the south, but I have no doubt that the treasures continue over there, too.

To find the Last Chance Road site from Salina, drive east on I-70 for about 34 miles to exit 89. At exit 89, a good dirt road curves east. Follow it for two miles, where another dirt road heads south. Take this road south for 5.4 miles to a fork. Take the right fork for another 3.8 miles to still another fork. Go right again for just .4 of a mile. At this point, you will see a large playa on your left. Pull in and park anywhere. Start filling those rock bags.

Although the dirt roads were wide and well graded when we were there, this spot is a long way from gas and fast food. Be sure that your vehicle is in top shape and that you are prepared, as it can get mighty hot out here in the summer and cold in the winter.

Marysvale

I can't even begin to count the number of times I have driven through Marysvale over the past 43 years or so. The only time I ever thought about rocks here, though, was once when Bill and Richard were little. We had stopped for gas, and the attendant gave the kids some snowflake obsidian from over in the Milford area. So, year

continued on next page

Salina/ *from page 61*

after year, we kept driving right by the banded rhyolite and fluorescent calcite which lies just about 3 of a mile from the highway. Makes me wonder how many other treasures I have been within arm's reach of and never found.

The rhyolite is certainly not gem quality, but it has nice swirls and patterns and makes a nice display. Of course, you can always make some more bookends you don't need, or a paperweight for Uncle Fred. You can even fire a piece at that midnight singing cat next door.

The white calcite crystals are not exceptional either, but they fluoresce a deep orange under shortwave UV light. There are some impurities in the matrix that fluoresce a nice green spiderweb effect, too. You only have 3 of a mile to go, so why not take some home?

The material is easy to find, but there are quite a few staked claims in the area. I don't know how old they are, but there is no need to bother them, anyway. There is plenty of material for all.

To reach the site from Salina, drive south on U.S. Highway 89 to the little town of Marysvale. In the center of town, there is an old stone building with a plaque and a bell in front. Zero your odometer here and head back north on Highway 89 for two miles. At that point, you will see a large black rock on the west side of the highway. Continue on for another 6 of a mile to a dirt track going west. Follow the track for 3 of a mile, park and hunt on the hillsides and in the washes. This last 3 of a mile is a little rough, so if your vehicle isn't up to it, just park off the highway and walk in. You may find some good stuff along the way. If you find some really good stuff, I probably dropped it, so please box it up and send it to me!

Salina

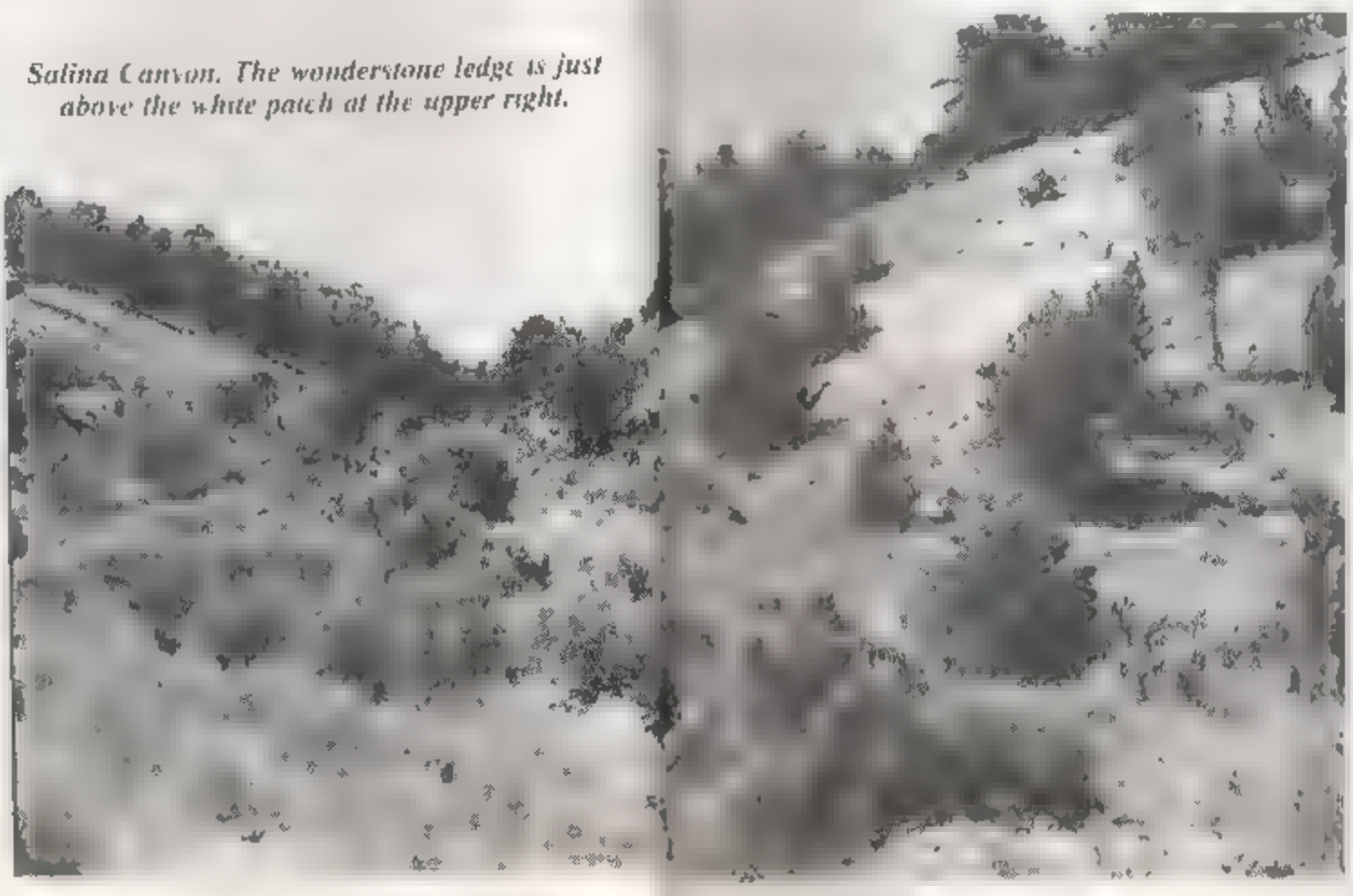
The Salina Canyon wonderstone site is an old one and has been dug, hammered and picked over for years. As with many such sites, however, there is still some nice material left for the patient, hard-working rockhound. Unlike the wonderstone at Vernon, the Salina stone is usually much harder. Although it does not take a high polish like agate, it will polish to a nice satin sheen. The patterns include swirls, bands and eyes, so it is important to study each piece before running to the saw in order to get the best "picture."

You will have to do some walking and a little climbing to find good material, but your patience will be rewarded. Look around the old workings that are clearly visible on the ledges for some chips, which will show you what to go after. Then try to find a seam and do some hard rock mining.

To reach the site from Salina, go east on Main Street from the intersection of U.S. Highways 50 and 89 for 2 of a mile to 300 East. Turn right on 300 East and follow it to the tunnel under I-70. Go through the tunnel and follow the forest road up Soldier Canyon for 3.1 miles to a fork. Take the right fork for about 3 of a mile. Here you will see a ledge on the left where a lot of digging has been done over the years. This is a good place to find some chips and small pieces of the material. If you don't find what you want at this ledge, look around on the others or go back to the fork and try the left-hand road. There is a lot of country to check out, so be patient and you will be rewarded.

These four sites offer a variety of material. I hope you get to visit all of them. Remember them if you are traveling along Utah's beautiful highways, and take a few rocks home. You can never have enough!

Salina Canyon. The wonderstone ledge is just above the white patch at the upper right.



Concepts For Gem Carving

How Many Artists "See" Their Design In The Stone

by Gerald L. Wykoff, GG, CSM

Michelangelo once explained how he consistently created the most magnificent sculptures in the art world. He said his mind's eye saw the form or shape he wanted to carve existing in the chunk of marble before he began. His task was merely to remove the stone that surrounded the shape, thus releasing the imprisoned statue.

Not unlike carving marble, gem carving takes place on a greatly reduced scale, but the approach is the same. Simply remove all the material that is not a part of the ultimate goal. In this light, steps are sequential and they are not too difficult. Primary among the steps though, is the visualization process.

You must first "see" the design. Inherent in that admonition is the realization that the actual stone or crystal shape dictates the limitations of the work; you can't carve a tall obelisk out of a square chunk of gem material.

Michelangelo spent countless hours, even days, at the famous Carrara and Siena marble quarries in Italy. There he searched for just the right piece of marble material. Before inspecting the great chunks of marble, he already had a picture of his intended sculpture in mind. Once he saw the shape in a chunk of marble, his search was finished. Just as with lapidaries, once an idea intersects with the appropriate material, a faceting project is soon under way.

Well, perhaps delay is warranted here, too. What separated Michelangelo from the rest of the sculptors of his time was the overpowering genius of his concepts. When you view the Pieta, the Moses or the David, your mind and emotions respond instinctively to the enormous power, grandeur and sweep of these creations.

World-renowned glyptologist Hazen Serras of Rockville, Maryland, remarks, "When I read many of the lapidary articles and features, I simply have to smile with amusement. Talking how-to-do-it is simply not something experienced sculptors or glyptologists do when they get together. The fact that you know how to cut or carve a gemstone is a given.

"What we talk about when we get together is concept, the idea behind the work. What is it about our ideas that will make our expressions stand out, be better – no, be superior, so they will be recognized by others as stamped with our own personality. Concept is what distinguishes a Michelangelo, a Rembrandt, a Rodin and a Munsteiner from the others."

A shaped gemstone is one thing. A gemstone shaped with imagination and with a firm concept in mind is something else entirely. The former is a stone or crystal that has had its shape altered, the latter is a work of disciplined artistic merit.

The stark, geometric concepts of Germany's Bernd Munsteiner burst the chains on imagination a few years ago, and sent lapidary into new directions. Since Bernd's hard fought breakthrough, his ideas have been copied, castigated, corrupted and condensed so much that his channeling technique is now almost a cartoon of itself. The original concept, though, emerging from an imaginative gemcutting mind that sought new adventures, is still as valid as ever.

Any individual with a minimum exposure to abrasive tools and equipment can wear away gem materials. It's not all that difficult. In similar fashion, anyone who can hold a wrench can work on a car engine. Now, whether or not the worn-away gemstone inspires awe and interest or whether the engine runs is what makes a distinction.

Before a gemcutter puts a gem specimen to an abrasive medium, she should have the goal already developed in her mind. It's that little mental trick genuflects to the distinction that New Hampshire's Michael Dyber draws between "technical proficiency" and "creative proficiency." One is merely good with tools, while another uses tools to carry out bold and creative journeys into the unknown. A carpenter can spend 20 years sawing a straight line across boards, while a builder with carpentry skills spends that same period experimenting with shapes, materials, forms, techniques, methods. At the conclusion of their apprenticeship, the builder boasts 20 years of experience and the carpenter merely points to 20 repetitions of one year's experience. Who do you want to build your dome?

Likewise, a faceter can spend 20 years dutifully duplicating the cutting specifications printed by others on a piece of paper, having done little to advance his skills. Does a cabber really advance in proficiency by constantly tracing and cutting oval cabs from templates?

A person simply has to think a bit. For years, experienced lapidaries have told beginners to let the shape and substance of the stone dictate where to go with it. In other words, don't force a shape or condition on the rough but rather allow its existing form to contribute to the finality of the thing. How many countless times have fine chunks of gem crystal rough never realized their promise because a gemcutter started out with a shape in mind and then forced the issue? A piece of crystal that cries out for a high yield rectangular or emerald shape shouldn't be arbitrarily subjected to the needs of a round or triangle cut without overwhelmingly good reasons to forge ahead with an exception. Certainly a gemcutter cutting a specific design for a client on a deadline represents one of those exceptions.

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...or Cosmos, a 214.2-carat Bolivian ...aragonite by Michael Dyber. To achieve ...ovale transitional illusion, Dyber ...arefully planned the use of frosted ...ol...ished areas along with his ...famous optical dishes.

Variety is available for bulk removal, but a small wedge helps to achieve a greater degree of precision when cutting a block of gemstone (left). Gemstone carving and sculpting does not require extensive tools. A flexible shaft device like this Foredom can usually be used to carve exquisite designs in gem material (right).

Carving/ from page 65

[illegible] through. Even holding a [illegible] to your hand do [illegible] terms of volume [illegible] salad' to round brilliant? Or [illegible] to the crystal's contours [illegible] would in your mind's eye [illegible] taking advantage of your rough's [illegible] exercises potential [illegible] Are you willing to work with a [illegible] forms until you have a better [illegible] impressive idea of what to do with [illegible] stone?'

Some of the finest carvers in America [illegible] allow enough specimens to sit [illegible] workbench for days, even weeks [illegible] seem to talk' to them. A few [illegible] map the specimen in clay or form [illegible] paper. An orientation that perhaps [illegible] be followed, which seems most appropriate. It's no [illegible] to change [illegible] orientation from time to time [illegible] gem's creative response.

Strengthening the Concept

Once you have a cutting goal in mind, [illegible] it may be advisable. To [illegible] creative or sculptural success, the possibilities should be fully appreciated. Maybe you can do what you have in mind with a particular piece of gem rough and have your cake. Only disciplined experimentation will demonstrate the truth. How many times has a faceter dopped up and started cutting a round shaped gem of a desired diameter only to find out that the rough wouldn't accommodate that dimension size. In response, the faceter generally goes back into the grinding or preform [illegible] operation and performs another 'take.'

When dealing with a large, rare, hard to replace, expensive piece of gem material you can't afford that kind of lapidary [illegible] recklessness. You need to know what's possible before you begin. The old rule of [illegible] is immutable. You can take away but you can't add.

This is demonstrated by the work of the above-mentioned artist, Helen Serras. Helen regularly does commission work for the royalty of the world. One of her finest projects was a 5-inch aquamarine carving of the Queen of Thailand, a piece commemorative of her reign. Before the artist ever touched an abrasive point to the huge chunk of aquamarine, she spent months developing and refining her concept.

Sketch after sketch, to lowest plaster cast after plaster cast, literally she made several dozen plaster casts of the rough before carving and then, after studying the stone and making several sketches, she began the actual carving work on one of the plaster pieces. The idea is to make first cuts in the plaster, assess their acceptance and then transfer the cutting to the stone itself.

Each of the plaster casts was carefully and sequentially carved, one after the other, offering up secrets and information concerning what Helen could and couldn't eventually perform on the actual stone. Something as simple as a slight tilt of the head had to be carved first into an identical plaster replica of the crystal to determine if the intended adornment would fit within the existing light parameters. Once that issue was solved, another element of the concept was sketched, then tested.

Sometimes more than one idea could be evaluated with a single plaster model. In any event, more than 17 separate plaster models were made, carved and carefully analyzed before the actual cutting began. Surprisingly enough, the final cutting of the aquamarine went rather swiftly. By the time Helen started 'releasing her concept' she'd carved the queen's face so many

Helen Serras of Rockville, Maryland, is shown comparing the many sketches and plaster models used in the successful Queen of Thailand aquamarine project.

[illegible] that the technical proficiency aspects [illegible] most relevant.

Another highly skilled gemstone carver, John Hargostian of Los Angeles, California often makes exceptional use of plaster molds on his more complex works and recognizes that the plaster technique should vary from carving to carving, but basically it consists of making multiple casts so the carver will have an accurate mold available at every important cutting junction.

Why do skilled, experienced sculptors like Serras and Hargostian use multiple plaster models rather than just one plaster? It would appear far easier and less time consuming if one mold is made of the rough stone. Cuts could then be made on the plaster and duplicated on the stone. This process could be repeated until both the plaster and the stone are completed accurately.

The fact that no carver can exactly duplicate the cutting on the two items explains the use of multiple plaster models. There will be minute differences and these differences must be reconciled. For that reason, talented carvers make plaster molds of their progress with the stone and do the "in front" or "to come" carving on the plaster. This way they have a constant reference or visual reminder of what should be ultimately accomplished with the gem material. A few of the more experienced carvers – with their ultimate goal vivid in their mind's eye – make plaster molds up to near completion and then go ahead with the gemstone finalization without a plaster model to work from.

Beginning carvers would probably be best served to finalize their work at the plaster and then, using it as a reference, complete the stone work.

A number of different techniques are used for making the plaster models. Serras uses a low temperature rubber molding compound that is available through many lapidary suppliers. It can be heated in an ordinary kitchen pan and then poured over the gem material. Once it sets up harmlessly on the stone, the rubber coating can be cut and the stone removed so that plaster can be poured in.

Hargostian uses Plasticene, the famous oil base modeling clay that won't dry out, yet hardens into a flexible but secure coating. You'll need to oil the stone before covering it with a ¼- to ½-inch blanket of the Plasticene. Not covering the top or one of the sides allows you to remove the stone – and later the plaster cast – without cutting or damaging the blanket. Of course, on difficult, complex stones with undercuts, you're better off blanketing the entire object.

Other excellent mold making materials include latex, urethane casting rubber and room temperature vulcanizing (RTV) silicone rubber. You can usually pick these items up at a plastic goods supplier.

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Plaster as well as dental stone, investment or pumice blocks can be used to make the mold as well as the casting replications. Before blanketing the gem with mold material, the gemstone will need to be fenced, i.e., flat, thin pieces applied on one end to line separate the rough gem into halves so the coating can be easily removed. Then apply some green soap to the gemstone and cover it with plaster. Next put the assembly in the refrigerator until the plaster sets up. Finally, use your hands gently to break the mold away.

Tools Needed

As for the technical aspects of gemstone carving, it requires less investment in tools than just about any other lapidary art. For all her knowledge and talent, Helen Serras uses little more than a Foredom flexible shaft tool with a selection of abrasive points. Haidostian performs all of his carvings with a Dremel Moto-Tool. Dyber has a comprehensive workshop with a wide selection of cutting tools he made himself, as well as huge 2-foot-diameter cutting-sanding wheels reminiscent of the big sandstone wheels used in Idar-Oberstein.

The late Maren Hirsch of Dallas, Texas, sat at a small table with a Foredom and some small carbide and diamond wheels, and turned out incredibly sensitive glyptographic works. For my own carving, I use large sanding wheels and Foredoms with a selection of silicone and diamond points.

If you're interested in trying your hand at carving, you should probably have the following tools available as a minimum:

- Trim saw (a 6-inch blade will suffice).
- Cab or grinding wheel setup (with 180 and 220 silicon carbide [SC] or diamond wheels).
- Flexible shaft tool, such as a Foredom or Dremel Moto-Tool.
- A selection of diamond or silicon carbide cutting points.
- Wheel materials such as wood, plastic, clay, glass, copper, bronze, aluminum, silicone, rubber composition, resin, etc. for those who make their own grinding-sanding-polishing wheels.
- Knife-edge greenstone or silicon (dental) grinding points.
- 4- or 6-inch felt polishing wheel and some small-diameter felt, leather or wood polishing points.

(Pertaining to the last item, if you're dissatisfied with the sanding and polishing results you obtain using wood wheels, it may be the kind of wood that's causing your problem. Here's a valuable wood tip from Michael Dyber: For wood wheels, use diffused hardwood. You can easily identify diffused wood because it invariably displays all its rings in the same color. Don't use wood where dark winter rings appear simultaneously with light summer rings. The presence of these different-colored rings are hints of a hardness variation and will result in a lumpy wheel. That means chattering at all speeds.)

Incidentally, when holding diamond grit in place on a steel or wood tool, you enjoy better results if you mix the polishing powder with polyethelate glycol. Ordinary holders, such as grease or oil, grip poorly on wood surfaces.

Technically speaking, two working approaches, both valid, dominate gemstone sculptors. The first approach employs a hand-held tool that is brought to and maneuvered about the piece. The second approach employs a stationary tool setup where the piece is brought to and maneuvered against the tool.

Helen Serras, master carver.

In both cases, you'll find that you can often make your own specialized carving instruments and tools. A wide variety of miniature wheels and points are available from most lapidary suppliers, but considerable savings—plus the benefit of customization—can be realized by the simplest of approaches. Serras purchases her cutting instruments but Haidostian makes most of his. He acquires chunks of old, discarded silicon carbide abrasive wheels and blocks. With a trim saw, he cuts them into thin squares and trims off the corners. Next he drills each section so they'll fit the small arbors for his Dremel Moto-Tool. To round up each slice, he merely runs the square against a diamond plate or another piece of silicon carbide. He uses the same technique to make and shape small points.

As for larger sanding and polishing wheels, they're quite easy to rig. Place a 6- or 8-inch hard felt or wood wheel on the arbor. Clean off the outer periphery with a screwdriver while the wheel is turning (get a good grip on the screwdriver, lest it be snatched out of your hands). Haidostian cleans the felt by applying and pulling away both sides of double-sided carpet tape to the wheel. He then cuts sanding or polishing strips to accommodate the wheel width, and sticks these to the cleaned felt with the same carpet tape.

By attaching the double-faced tape to a wheel and leaving the paper on the other side, you can use this waxed paper as an effective polishing surface. During use, the wax heats up a bit and grips polish powder with remarkable tenacity.

Use Saw Judiciously

Given a splendid array of cutting wheels, points and other abrasive tips and tools, the experienced carver still realizes that his best bulk-removing lapidary device is the common trim saw. You may prefer to cut into the rough crystal with a mind's eye set on the entrapped shape, or mark up the rough piece extensively with cut lines. Regardless, the quickest, surest method to remove bulk material and get down to this more refined cutting area—and conserve the life of your more expensive abrasive tools—lies with the diamond saw blade.

A faceting preform or cabochon represents pretty much flat sawing. A carving, though, usually makes severe angled cutting demands. To meet these angle requirements, pick up a piece of steel or aluminum angle plate—or make an angle plate out of wood or plastic. With a hack saw or band saw, cut a slot into the front of the plate. This will enable you to push the stone and plate directly into the blade with only the stone making sawing contact.

An angle plate rests securely on the sawing platform and, by itself or with proper shimming, introduces the stone to the saw blade from a variety of useful directions. It's not much of a chore to hold the stone securely to the plate with your fingers while the blade advances into the stone.

Every gemcutter should consider the benefits of developing carving or sculpting skills. They can transport an individual's work to new, higher levels. The tools are readily available and investment in motorized equipment can be minimal.

In short, effective carving of a gemstone generally involves two vital phases—concept and technique. A gemcutter would be well-advised to invest considerable conceptual time into any project, following the age-old bromide: "Plan the work, and then work the plan."

For a gemcutter who would like to try or develop carving skills, many excellent books are available. As for cutting equipment, carving demands few tools. One can make his or her own cutting wheels and points and sanding-polishing wheels. But the real demand of carving or sculpting comes before the tools even touch the stone. What often separates the gifted from the run-of-the-mill lapidaries isn't so much their technical proficiency, but their conceptual proficiency.

The Nevada Mining Story

The W. M. Keck Museum Is A Good Reason To Visit Reno

A view from the mezzanine of the many antique display cases at the W. M. Keck Museum.

The original cage from the Consolidated and California Shaft in Virginia City. Note the lantern attached on the right and the Burleigh drill in front.

One of the many beautiful specimens that grace the Keck exhibits.

This soup tureen is one of over 100 pieces of the Mackay Silver Collection, all of which were created by the Tiffany Company in New York.

by Sherril Steele-Carlin

It's a pretty safe bet that a museum on a university campus isn't the first thing visitors think about when they come to Reno. Most people stay inside the casinos, desperately pulling handles on slot machines. However, a few visitors make their way a little bit north, to the University on the hill, to look for the Keck Mineral Museum on the University of Nevada, Reno campus. Just a short walk from the hustle and bustle of the casinos, this exceptional museum is much more than oak and glass display cases filled with specimens. When you step inside, it's like taking a step back in time.

The goal of Keck Museum is to "preserve the past, understand the present, and prepare for the future." To accomplish this, the museum shows the story of Nevada mining. It's the story of hard-rock miners who sweated for $4 a day in the tunnels underneath Virginia City.

Many men carried their lunch pails down a shaft in the morning, never to see the light of that day. They braved fires, hidden steam vents and explosions to bring the ore to the surface and make the mine owners rich. Those fearless men forged Nevada's very existence. These men found the treasures displayed at the museum for everyone to enjoy—silver, gold, copper and dozens of other minerals.

It was these specimens of silver that put Nevada on the map and helped to give her statehood. Silver started wild stampedes to no-name sites in the desert. It changed men's lives for better and worse. We know Nevada as the Silver State, and this museum is a celebration of the ore that gave her life.

A complete tour of the Keck Museum covers three stories of exhibits housed in the historic Mackay School of Mines. The minute you walk through the front door, the past swirls around you and the rooms give off an aroma of oiled wood and earthiness. The basement contains storage areas not open to the public, and two displays of mining memorabilia.

A dark, mysterious room greets visitors at the foot of the basement stairs. Inside visitors see silver ore in one of its most precious forms—sparkling, gleaming pieces of Victorian art. James W. Mackay of Comstock Lode fame took more than $105,000,000 in silver from his mines. He kept a little for himself and had it made into ornate pieces of Victorian table service for his family. Some of these pieces are in the basement in a specially constructed display vault. A dark, dramatic backdrop and track lighting bring out dazzling highlights in the decorative carving. The size of a small tree, a silver candelabrum that holds two dozen candles is a testament to Victorian splendor. This ornate service is one of the best-known displays in the museum, and seeing it is

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Tucked away in a corner behind the Mackay Collection are some of the surveying instruments engineers used in the construction of the Sutro Tunnel. The tunnel Adolph Sutro created to drain the Virginia City mines was an engineering miracle in 1878. It took him nearly nine years, but Sutro managed to bore through almost four miles of Mount Davidson to drain the mines. The steaming ground water in the mines was dangerous and deadly. If miners hit a pocket by accident while drilling, the boiling water could instantly scald them to death. The water kept the internal temperatures of the mines so hot that men could only work 15 or 20 minutes at a time before they had to take a break. Ice was one of the most popular ways to cool off, and the mines went through thousands of tons of it every year. Sutro's tunnel drained the hot water, and helped save many a miner before the mines went bust in the 1880s. To see some of the instruments that helped bring that 20,484-foot miracle to life is awe-inspiring.

Across from the Mackay Collection is another snapshot in time, a replica of the office of J.D. O'Brien. Mr. O'Brien worked in Beatty, Nevada, from 1901 through 1939 as a mining engineer. Staring through the windows into the room that re-creates his office, you get the feeling you've gone back to a quieter, simpler place. Old accounting ledgers, a menu from the Montgomery Cafe and oil lanterns give the impression that if you could only get inside that room, time might stop for you. Closing your eyes, you can almost hear the tapukety, tapukety of a Model-T Ford chugging down the dirt streets, and smell the dust cloud kicked up by the narrow tires.

On the main floor, black-and-white panoramic photos of long-forgotten mining towns line the walls above the display cases. Some of their names are reminiscent of the homes miners left behind—Manhattan, Dayton, Washington, Dixie, Rochester, Jersey City, Austin and Charleston. Some of them speak of the hope the men felt, and what they were hoping to find—Good Hope, Eureka, Bonanza, Jumbo and Midas.

In the display cases, hundreds of rock samples are organized according to the type of mineral and the area where they were found. Quite a few immense quartz crystals are on display, along with myriad familiar minerals such as goethite, turquoise, pyrite, laterite and brucite. There are also many rare and unusual specimens that collectors and enthusiasts will appreciate. Cases line the walls and fill the interior of the museum, leaving just enough room to walk between the rows. There are also large specimens scattered around on the floor underneath the cases, including some very attractive petrified wood samples.

The layout of the museum hasn't been altered since 1908. As you enter, the right side of the museum houses Nevada ores, arranged by their county of origin. Include are two full cases of Comstock ore, just a other testament to the importance of Vi ginia City in Nevada history. The cases the center contain the economic ore arranged by their use.

Visitors to the museum can find treasure tucked away in every nook and cranny Space is precious, and there will never b enough to display the entire collectio Meanwhile, every corner is fair game for treasure awaiting discovery. Hidden awa in one back corner of the main floor is Joh Mackay's original safe, made by th Diebold company. Mackay used the elab rate safe when he was a mine superinten dent. Later, he and his three partners, Flo Fair and O'Brien, hit a great new ledge silver ore in Virginia City. This bonanz brought a second life to the Comstock du ing the 1870s.

Ancient fossils and maps line the wall of the second floor, along with some mi ing machinery of bygone days in Virgini City. You'll find several hard-rock Burleig drills developed as the mines expanded make it much easier to plant explosiv charges. An elevator cage from the Conso idated Virginia Camp shaft stands ready carry men into the depths of the earth. A other personal favorite is the ornate bullio scale, as tall as a man.

The Mining Museum has been a part o the Mackay School of Mines since 190 but the collection of ore and minerals ha been traveling around Nevada since 186 In fact, the second employee ever hired b the Nevada University system was the stat mineralogist, who took care of the collec tion, among many other duties. First calle the "Nevada Collection," it was originall housed in Carson City, then moved to sev eral sites at the University of Nevada Reno. Shortly after the Mackay School o Mines opened in 1908, the museum finall found a permanent home in the northwes corner of the building. The basement an third floors were added later.

A grant from the W. M. Keck Family i 1991 made it possible to completely re model and renovate the museum. The ol cases are now refinished originals de signed to resemble display cases at Co lumbia University's mineral museum. Th museum faces the historic quadrangle o the university in the Mackay School o Mines, one of the oldest buildings on th campus. When you visit, don't miss th statue of John W. Mackay in front of th school. Gutzon Borglum, the same ma who created Mount Rushmore, carved th Mackay statue.

The W. M. Keck Mining Museum in th Mackay School of Mines is a hidden gem on the University of Nevada, Reno cam pus. It is open weekdays from 9:00 a.m. t 5:00 p.m. Visitors can spend just a few minutes glancing at the cases, or hours en joying every little specimen and photo. Ei ther way, you won't want to miss it o your next visit to Reno.